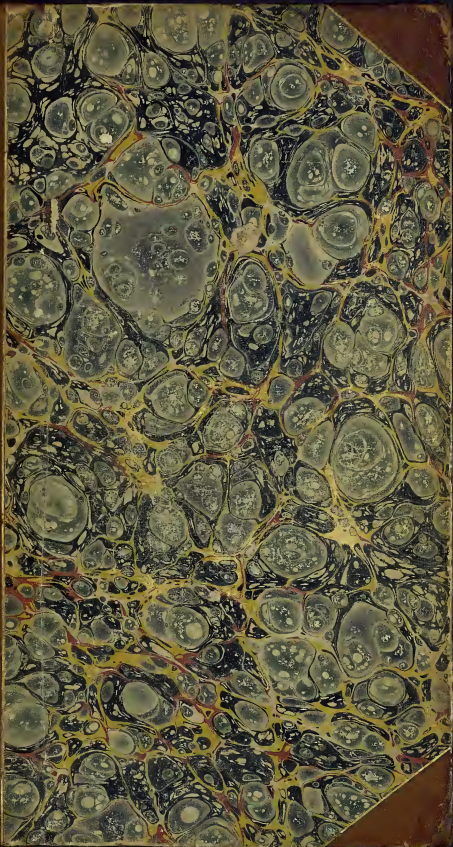




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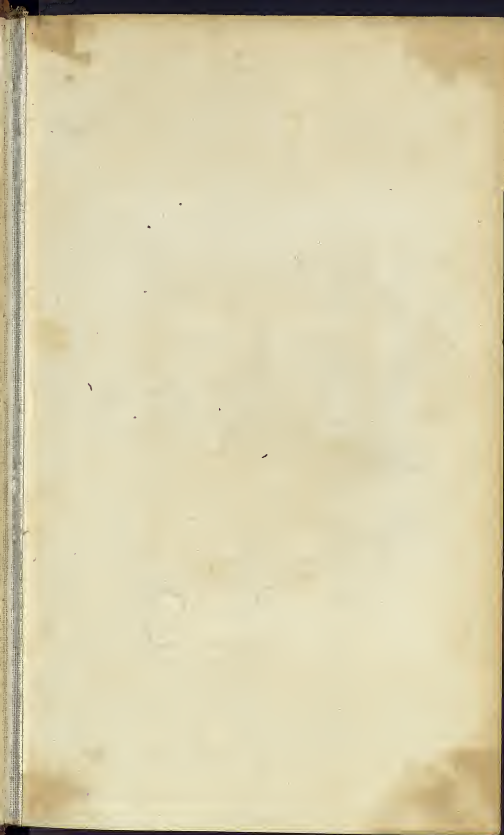
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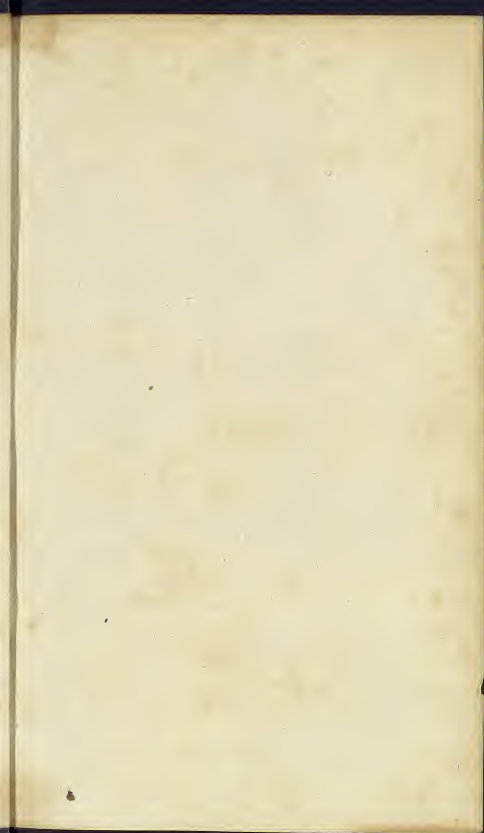


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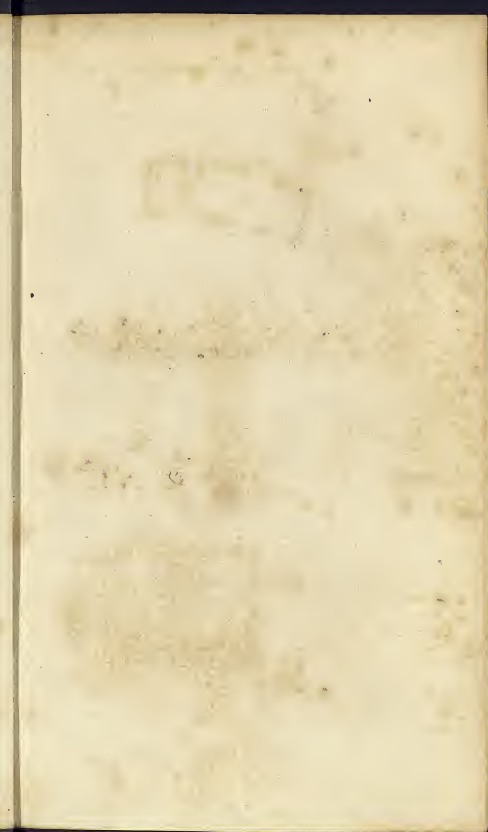
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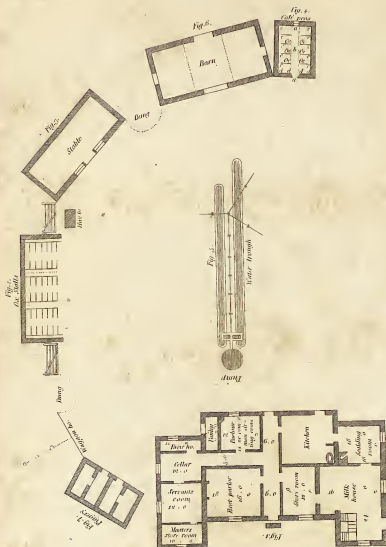








Plan of a Farm Yard and Offices.



THE
COMPLETE GRAZIER;
 OR
 FARMER'S AND CATTLE-BREEDER AND DEALER'S
 ASSISTANT.

COMPRISING

Instructions for the Buying, Breeding, Rearing, and Fattening of Cattle.

Directions for the Choice of the best Breeds of Live Stock.

The Treatment of their Diseases, and the Management of Cows and Ewes, during the critical Times of Calving and Yearning.

The general Economy of a Grass Farm.

Irrigation, or Watering of Meadows.

Culture of the best natural and artificial Grasses and Plants for Fodder.

Various Methods of cutting, mixing, and preparing Food in severe Winters and Seasons of Scarcity.

The Economy and general Management of the Dairy, including the Making, Curing, and Preservation of Butter and Cheese, &c. &c. &c.

TOGETHER WITH AN

INTRODUCTORY VIEW

OF THE DIFFERENT BREEDS OF

NEAT CATTLE, SHEEP, HORSES, AND SWINE:

Also AN APPENDIX on the

Shepherd's Dog, Horses, Asses, Mules, Poultry, Rabbits, Bees,
 FARM ACCOUNTS,

AND ON THE IMPROVEMENT OF
 BRITISH WOOL.

BY A LINCOLNSHIRE GRAZIER:

Assisted by Communications from several Yorkshire, Leicester, and Norfolk Farmers.

FOURTH EDITION.

REVISED, CORRECTED, ENLARGED, AND GREATLY IMPROVED.

Illustrated by numerous Engravings.



LONDON:

PRINTED FOR BALDWIN, CRADOCK, AND JOY, PATERNOSTER ROW:
 AND SOLD BY ALL BOOKSELLERS.

1816.

ADVERTISEMENT

TO THE FOURTH EDITION.

THE very favourable reception given to the three former impressions of this Work, demands the Editor's warmest acknowledgments: and since the rapid sale of those editions has rendered a *fourth* necessary, he deems it his duty to say, that no exertions have been spared, to make the present work deserving of the liberal patronage it has received, by incorporating every material fact that has recently occurred. The whole Work has undergone a most careful revision: and in addition to the various new information introduced in almost every page, the Editor has now given numerous interesting particulars, which will be found under the Heads—Sheep—Grasses—Bees—Wool—Farm-Accounts, &c.—subjects these of considerable moment to the Farming Public; to whom it is hoped that this Work will prove not less acceptable in its present improved state.

January 1,
1816.

TESTIMONIES *in favour of this Work.*

" We are convinced, we cannot perform a more useful service, than to recommend this Volume, as a *Book of Constant Reference.*" AGRICULTURAL MAGAZINE, Vol. XIV.

" This is a judicious Publication." ANNUAL REVIEW, for 1807.

" *Not only as the first publication on this department of Rural Economy, but as a very well digested and comprehensive Work,* the "Complete Grazier," deserves particular praise. The author has been judiciously sparing of his own unauthenticated instruction, and has for the most part referred to his authors, on topics of peculiar importance or uncertainty. It is a great merit that he has preserved it so pure from local prejudices, and, as we think permitted no personal interest to supersede the rights of truth and integrity." ECLECTIC REVIEW, for September 1807.

P R E F A C E

TO THE FIRST EDITION.

AMONG the various publications which, of late years, have issued from the press on different subjects of rural economy, none has hitherto appeared on that department which is here more particularly treated upon. With a view to supply such deficiency, the present work was undertaken; in which it is attempted to concentrate every important fact connected with the rearing, breeding, feeding, fattening, and diseases of Cattle, (so far at least as the present imperfect state of veterinary medicine will allow), as well as on the general economy of a Grass-farm. Such as it is, the editor now submits the result of his labours—founded partly on personal knowledge, and, where that was deficient, on the experience of others—to the candour of a British Public: conscious that, though it be not faultless, he has sedulously avoided the introduction of speculative opinions, or of

PREFACE.

undue assertions, while no efforts have been omitted to render the present work a useful compendium of facts, connected with the peculiar branch of rural economy which is therein discussed.

CONTENTS.

INTRODUCTORY VIEW OF THE DIFFERENT BREEDS OF BLACK CATTLE, SHEEP, AND SWINE, REARED IN GREAT BRITAIN.

Section I.

NEAT CATTLE - - - -	Page 1
1. Wild Race - - - -	<i>ib.</i>
2. Devonshire Breed (with figures) - - - -	2
3. Dutch, or Short-Horned Breed (with figures) - - - -	3
4. Lancashire Breed (with a figure) - - - -	4
5. Galloway, or Polled (with a figure) - - - -	5
6. Highland Breed, or Kyloes (with a figure) - - - -	6
7. Alderney, or French Breed -	<i>ib.</i>
8. The Lowland Breed - - -	7
9. Welsh Breed - - - -	<i>ib.</i>

Section II.

SHEEP.

Different BREEDS, both native and foreign, which are reared in Great Britain.

Class 1.—SHEEP WITHOUT HORNS.

1. Dishley, or New Leicester Breed (with a figure) - - -	8
2. Lincolnshire Sheep - - -	9
Variety 1.—Teeswater Breed	<i>ib.</i>
Variety 2.—Cotswold; or improved Gloucester Breed	<i>ib.</i>
3. Dartmoor, or Devonshire Natts - - - -	<i>ib.</i>
4. Herefordshire, or Ryelands	10

5. South-Down (with figure) -	10
Variety.—Cannock Heath Sheep - - - -	11
6. Romney Marsh - - - -	11
7. Herdwick Breed - - - -	<i>ib.</i>
8. The Cheviot Sheep - - -	<i>ib.</i>
9. The Dun-faced Breed - -	12
10. The Shetland Breed - -	<i>ib.</i>

Class 2.—HORNED SHEEP.

11. The Exmoor Breed - - -	12
12. The Dorsetshire Breed - -	13
13. The Norfolk Sheep - - -	<i>ib.</i>
14. Heath, Linton, or Forest Sheep (with a figure) - - -	<i>ib.</i>
15. Merino or Spanish Sheep (with a figure) - - - -	14

Section III.

HORSES.

1. Clydesdale Horses - - -	16
2. Cleveland Bays - - -	<i>ib.</i>
3. Suffolk Punches (with figures) - - - -	17
4. Old English Draught Horse	18
5. Observations on the age of Horses (with engravings) -	<i>ib.</i>

Section IV.

SWINE.

1. Berkshire Breed (with figure)	23
2. Chinese, or Black Breed (with figure) - - - -	<i>ib.</i>
3. Gloucester - - - -	24
4. Hampshire - - - -	<i>ib.</i>

CONTENTS.

5. Highland, or Irish Breed	- 24	Various Methods of rearing them	
6. Northampton Breed	- ib.	without Milk	- 47
Variety.—The Shropshire Breed	- ib.	Fattening of Calves	- 54
7. The Rudgewick Breed	- ib.	Castration of Calves	- ib.
8. The Swing-tailed Breed	- 25		
9. Large, Spotted, Woburn Breed (with figure)	- ib.		

Section V.

OF THE OX	- 55
Characteristics of good Oxen	- 56
Best methods of breaking them for work	- 56
of working them to most advantage	- 58
Shoeing of Oxen	- 59
Investigation of the comparative Utility of Horses and Oxen, for the purposes of Husbandry	- 60
1. With regard to their original price or cost	- 61
2. With respect to Labour	- 62
3. Comparative Expense of keep, and general savings	- 64

Section VI.

OF SHEEP.

On the Selection of Sheep	- 69
Characteristics of a good Ram	- 70
Choice of Ewes for breeding	- 71
Management for Ewes before and during Gestation	- 72
And at the time of Yearning	- 74
Proper time for gelding Sheep	- 78
Sheep-shearing	- 79
Marking Sheep	- 83
Assortment and division of Sheep into Flocks	- ib.

Section VII.

Of the treatment and rearing of House Lambs	- 84
---	------

Section VIII.

OF THE HOG	- 86
Characteristic marks of a good Hog	- ib.
Selection of Swine for Breeding.	- ib.
Management of Sows, during the Season of farrowing	- 87
Hints for preventing imposition in the buying and selling of fat or lean Swine	- 89

CHAPTER I.

OF CATTLE.

Section I.

On the choice and treatment of Cattle	- 26
General Observations on buying and stocking a Farm with Cattle	- 27
Principles of Selection, necessary to be attended to in choosing Cattle	- 28
Age of Sheep	- 32
of Neat Cattle	- ib.

Section II.

OF THE BULL	- 33
Sketch of the Natural History of the Bull, together with a comparative view of the different Breeds of Black Cattle	- ib.
Description of a well proportioned Bull	- ib.
Contrivance for preventing accidents from mischievous Bulls (with figures)	- 35
Comparative advantages of various Breeds	- 36
Irish Cattle	- 38

Section III.

OF THE COW	- 39
Description of a good Cow	- ib.
Proper time for Cows taking the Bull	- 41
Management of Cows before and after Calving	- 42

Section IV.

OF THE CALF	- 46
Treatment of Calves, when first dropped	- ib.

CONTENTS.

CHAPTER II.

FARM-HOUSE and OFFICES.

Section I.

THE FARM HOUSE - - - - -	90
Proper Situation for a Farm House - - - - -	91
Requisites, in planning a Farm House - - - - -	92

Section II.

FARM OFFICES.

§ 1. Ox-Stalls, or Feeding Houses (with a figure) -	94
2. Stable (with engravings) - - - - -	98
3. Barn - - - - -	101
4. Cart and Tool House - - -	103
5. Calf Pens - - - - -	ib.
6. The Piggery - - - - -	104
7. Straw and Root Houses (with a figure) - - - -	106
8. Water - - - - -	107
On the making of Wells -	108
of Ponds, (with a figure) - - -	109
9. The Dunghill - - - - -	111
10. The Kitchen Garden - - -	114
11. Pound - - - - -	115
12. Farm-cottages - - - - -	ib.

CHAPTER III.

ON THE FEEDING AND FATTENING OF CATTLE.

Section I.

Of the Pasture and other Food best calculated for Cows, as it respects their Milk -	116
Pasturing of Cows - - - -	117
House feeding of Cows - - -	118

Section II.

On the feeding and fattening of Neat Cattle - - - - -	124
---	-----

Stock to be selected with regard to situations - - - - -	124
Names given to Neat Cattle, at different ages - - - - -	125—note
Grazing of Cattle - - - - -	126
Examination of advantages and disadvantages resulting from the hard or light stocking of Pastures - - - - -	130
Soiling of Cattle, its advantages - - - - -	132
Plants and Vegetables useful for soiling and Stall feeding -	140
Account of the Norfolk method of turnip feeding - - - -	142
Various articles, beneficially employed in feeding Cattle -	146
Quantity of food, eaten (upon an average) by each Beast -	153
Regularity in feeding, and cleanliness, indispensably necessary in feeding Cattle - - - -	155
Best time for disposing of fat Stock - - - - -	157
Hints for ascertaining the weight of Cattle - - - - -	159

Section III.

ON FEEDING AND FATTENING SHEEP - - - - -	163
Different names given to Sheep at various ages - - - - -	ib.
Grazing of Sheep - - - - -	163
Advantages and disadvantages of the folding system - - -	166
On feeding Sheep with roots, especially turnips - - - -	170
Experiments of Rev. Dr. Cartwright on feeding them with Sugar - - - - -	171
Economical contrivance (with a figure) for giving food to Sheep - - - - -	176
Utility of Salt in preserving the health of Sheep - - - -	178
On extirpating the Horns of Sheep - - - - -	179

Section IV.

ON FEEDING AND FATTENING SWINE - - - - -	181
1. Sows in Pig - - - - -	ib.
2. Young Pigs - - - - -	182
3. Store Pigs - - - - -	ib.
4. Fattening of Hogs - - -	183

CONTENTS.

Hints for the curing of Bacon	
and Hams	187
Salting Swines' flesh for Pork	188

CHAPTER IV.

DISEASES OF CATTLE.

Influence of the Weather on the health of Cattle	189
Account of natural Phenomena, which indicate approaching changes in the Atmosphere	190

Section I.

Diseases incident to Cattle in general	193
1. Colds	194
2. Colic, or Gripes	ib.
3. Foul	195
4. Hoven, or Blown (with figures)	ib.
5. Looseness, or Scouring	199
6. Pantas, or Panting Evil	200
7. Poisons	201
8. Red Water, or Bloody Urine	ib.
9. The Staggers	202
10. Wounds	ib.

DISEASES PECULIAR TO COWS.

11. Cough, or Hoosing	203
12. Puerperal, or Milk Fever	204
13. Affections of the Udder	205
DISEASES PECULIAR TO OXEN	ib.

Section II.

DISEASES OF CALVES.

1. The Cords	206
2. Cough	207
3. Gut Tie	ib.
4. Scouring, or Looseness	ib.
5. The Shoote	208

Section III.

DISEASES OF SHEEP.

1. Blindness	208
2. The Blood	209
3. Dunt	ib.

4. The Flux	210
5. The Fly	ib.
6. The Foot Halt	211
7. Foot Rot	ib.
8. Gall, or Scower	214
9. Hoven, or Blown	ib.
10. Hunger Rot	ib.
11. Pelt Rot	ib.
12. Red Water	ib.
13. Rickets	215
14. The ROT	216
15. The Rubbers, or Rubs	225
16. Scab	ib.
17. The Tick	227
18. Affections of the Udders of Ewes	228
19. White Scour	ib.
20. Wounds	ib.

Section IV.

DISEASES OF LAMBS.

1. Black Water	229
2. Red Water	ib.
3. Skit	230

Section V.

DISEASES INCIDENT TO SWINE.

1. Gargut	230
2. Fever	231
3. Disorders of the Lungs	ib.
4. The Mange	ib.
5. Measles	ib.
6. Murrain	232

CHAPTER V.

IMPLEMENTS OF HUSBANDRY.

Section I.

WHEEL CARRIAGES	233
Waggons	ib.
Irish Car (with a figure)	235
One Horse Cart, (Lord Robert Seymour's, with a figure)	238
Lord Somerville's Drag Cart (with a plate)	239
Cornish Wain	240
Rolling Cart	241

CONTENTS.

Section II.

CHAFF CUTTERS AND BRUISING MILL.

Description of Mr. Salmon's Chaff Cutter (plate) - - -	242
of Mr. M'Dougal's Chaff Cutter (plate) - - -	244
of Mr. Pasmore's Straw Cutter and Bruising Mill (plate) - - -	245

Section III.

PLOUGHS.

1. Rotherham Plough - - -	247
2. Small's Patent, or Chain Plough - - -	ib.
3. Scottish Plough (with an engraved figure) - - -	248
4. Beverstone Plough (Mr. Tugwell's, with a figure) - -	249
5. Herefordshire Wheel Plough	251
6. Kentish Turn-wrest Plough	ib.
7. Double, or two furrow Swing and Wheel Ploughs - - -	ib.
8. Paring Plough - - -	252
9. Trench Plough - - -	ib.
10. Drill Ploughs - - -	253
Mr. Tull's - - -	ib.
Mr. A. Young's - - -	ib.
Mr. Amos's - - -	ib.
Mr. Cook's - - -	ib.
Mr. Munning's Turnip Drill (with figures) -	254
Mr. Knight's improved Turnip Drill (with figures) - - -	255
Hand Drill - - -	257
11. Mole Plough, for Draining	258
Mr. Watts's Mole Plough - -	ib.
The Duke of Bridgewater's Draining Plough (with figure)	259

Section IV.

SCARIFIERS AND HOES - - -	261
Messrs. Lester and Hayward's Cultivators - - -	ib.
2. Mr. Dudgeon's Grubber - -	ib.
3. Mr. M'Dougal's Scarifier (with figure) - - -	ib.

4. Dutch Hoes - - -	265
5. Prong Hoes - - -	ib.
6. Mr. M'Dougal's Hoe (with figure) - - -	ib.
7. Mr. Duckett's Hoe - - -	265
8. Turnip Hoe - - -	ib.

Section V.

HARROWS - - -	267
1. Brake and Bush Harrows -	ib.
2. Mr. Lester's improved Harrow - - -	268
3. Mr. A. Young's improved Harrow - - -	269
4. Mr. Knight's improved Harrow - - -	ib.
5. Mr. Wilde's Patent Harrow	ib.
6. The Hon. Mr. Sandiland's Chain and Screw Harrow (with figure) - - -	270
7. Wrack Harrow -	271
8. Mr. Jeffery's Improved Harrow - - -	272

Section VI.

DRAGS - - -	273
-------------	-----

Section VII.

ROLLERS - - -	ib.
---------------	-----

Section VIII.

CHURNS.

1. Messrs. Wright's Churn (with figures) - - -	274
2. Mr. Bowler's improved Churn (with figure) - -	275

CHAPTER VI.

OF SOILS.

Different sorts of Soils—Various modes of improving, and converting them from a state of nature—Manures—Fences—Formation and Management of Meadows—Irrigation. 277

CONTENTS.

Section I.

DIFFERENT SORTS OF SOILS.

Analysis of Soils	277
1. Vegetable Mould	279
2. Clay	ib.
3. Loam	281
4. Gravelly and Sandy Soils	282
5. Chalk	283
6. Peat	ib.

Section II.

DIFFERENT MODES OF IMPROVING LAND.

1. Draining, different sorts of	286
Hollow Draining	287
Sod, or Earth Drains	288
Stone Drains	ib.
Draining of Lands where no fall can be obtained (with figures)	290
Draining of uplands (with figures)	293
Description of Mr. Eccleston's Peat Borer (with figure)	296
Obstructions of Drains	297
2. Fallowing	298
Advantages and disadvantages of the Fallowing System, discussed	ib.
3. Paring and Burning	301
4. Impediments to the Plough and Scythe, how removed	304
1. Ant Hills	ib.
2. Mole Hills	418
2. Stones	305
3. Weeds (with figure)	306
4. Wood	313
5. Ploughing	314
6. Harrowing	317
Rolling	318
7. Irrigation	ib.
Construction of Water-Meadows on level Ground	319
Formation of Water Meadows, on uneven Ground (with figures)	321
Soils most suitable for Irrigation	327
What kind of Water is best calculated for this purpose	329

Proper Seasons for Irrigation	335
American method of watering Meadows	339
Estimate of the benefit resulting from Irrigation	340
8. Warping	341

Section III.

OF MANURES IN GENERAL, and their application to Tillage, Grass and Meadow Lands.

I. VEGETABLE MANURES	346
1. Vegetable Ashes	ib.
On the conversion of Moss into a valuable Manure	347
2. Straw	354
3. Weeds	355
4. Sea Weeds	356
5. River or Pond Weeds	ib.
6. Pulverised Rape, or Cole Seed Cake	ib.
7. Malt Dust	357
8. Oak Bark	ib.
9. Green Crops ploughed into the Land	ib.
10. Wood Soot	358
11. Furze Ashes	ib.
II. ANIMAL MANURES	359
1. Dung	ib.
2. Urine	361
3. Tallow Chandlers, Curriers, &c. Waste	362
Fish	ib.
5. Bones	363
6. Horn Shavings	ib.
7. Damaged Wool	ib.
III. FOSSIL MANURES	ib.
1. Crag	364
2. Clay	ib.
3. Chalk	365
4. Coal Ashes	ib.
5. Soap Boilers Ashes	366
6. Gypsum	367
7. Lime	370
8. Marl	373
9. Salt	375
10. Sand	376
11. Soot	ib.
IV. FLUID MANURES	376
Mud	377

CONTENTS.

V. Compound Manures	- 378
VI. Preservation of Manures	- 380
VII. Application of Manures	- 384
Rules for manuring	
Land	- 386

Section IV.

INCLOSING OF LAND—SIZE AND SHAPE OF FIELDS.

Size of Inclosures	- 390
Shape of Fields	- 393

Section V.

FENCES.

1. Earth-Banks	- 394
2. Walls	- 395
3. Hedges	- 396
Plants best calculated for	
hedges, and mode of	
raising them	- 397
Plashing of hedges	- 404
4. Ditches	- 405
5. Gates	- 406

Section VI.

CULTURE AND MANAGEMENT OF PASTURE LANDS.

1. Pasture	- 408
Proper modes of laying	
down Land for Pas-	
ture	- <i>ib.</i>
2. Meadows	- 410
Soils, proper to be con-	
verted into meadows	- 411
Requisites to constitute a	
good meadow	- 412
Hints for collecting, pro-	
curing, and preserving the	
best grass-seeds	- 413
Of the grasses suited to dif-	
ferent Soils	- 419
1. Clay	- <i>ib.</i>
2. Loam	- 420
3. Sandy Soils	- 421
4. Chalk	- <i>ib.</i>
5. Peaty Soils	- <i>ib.</i>
Grasses proper for,	
1. Uplands	- 422
2. Midlands	- <i>ib.</i>

3. Lowlands, or Mea-	
dows	- 423
4. Fens, with hints	
for the peculiar	
management of	
those Soils	- 424
Time for sowing grass-seeds	- 431
Hints for improving and beauti-	
fying Pastures	- 432
Mowing	- 437
Hay-Making	- 438
Middlesex Method de-	
scribed	- 439
On making Hay from the	
grass of <i>Water Meadows</i>	- 443
On the Stacking, or Housing of	
Hay	- 444
On preventing hay-stacks from	
taking fire (with cut)	- 446
Rouen, or Aftermath, nature of	- 450
Beneficial purposes for which it	
may be employed	- 451

CHAPTER VII.

OF GRASSES.

Grasses best calculated for Meadows and Pastures.

Section I.

NATURAL GRASSES, USUALLY CUL- TIVATED.

1. Crested Dog's Tail	- 452
2. Darnel, or Ray Grass	- 453
3. Meadow-Fescue	- 454
4. Meadow-Fox-tail	- <i>ib.</i>
5. Smooth-Stalked Poa, or	
Meadow-Grass	- <i>ib.</i>
6. Sweet-Scented Vernal, or	
Spring-Grass	- 455
7. Yorkshire White, or Mea-	
dow Soft-Grass	- <i>ib.</i>

Section II.

WILD, OR UNCULTIVATED GRASSES, WORTHY OF CULTIVATION.

1. Sheep's-Fescue	- 456
2. Hard-Fescue	- <i>ib.</i>

CONTENTS.

3. Annual Poa, or Meadow Grass - - - - -	456	3. Borecole, its culture - - -	476
4. Rough-Stalked Poa, or Meadow Grass - - - - -	457	4. Burnet - - - - -	ib.
5. Silver Hair-Grass - - - -	ib.	5. Cabbage, varieties of, worthy of cultivation - - - - -	477
6. Creeping Bent-Grass or Fiorin - - - - -	457	Culture of - - - - -	478
7. Tall Oat-Grass - - - - -	459	6. Carrot, culture and preservation of - - - - -	ib.
8. Yellow Oat-Grass - - - -	ib.	7. Parsnips - - - - -	480
9. Flat-Stalked Poa, or Meadow Grass - - - - -	460	8. Buck-wheat - - - - -	481
10. Meadow Cat's-Tail, or Timothy Grass - - - - -	ib.	9. Furze - - - - -	482
11. Yarrow - - - - -	461	10. Rye - - - - -	ib.
12. Rib-Grass - - - - -	462	11. Oats, varieties of - - -	483
13. Cock's-Foot Dactylis, or Rough Cock's-Foot - - -	ib.	Their culture - - - -	ib.
14. Blue Dog's-Tail Grass - -	463	12. Pease, varieties and culture of - - - - -	484

AQUATIC PLANTS.

1. Flote-Fescue - - - - -	ib.
2. Water-Hair-Grass - - - -	ib.
3. Flote-Fox-Tail - - - - -	ib.
4. Water Poa, or Reed-Meadow-Grass - - - - -	ib.

Section III.

ARTIFICIAL GRASSES OR GREEN CROPS - - - - -

1. White or Dutch Clover -	465
2. Red Perennial Clover -	ib.
3. Hop Clover - - - - -	ib.
4. Common Clover - - - -	ib.
5. Lucerne - - - - -	466

Comparative view of the great advantages resulting from the Cultivation of Lucerne - - - - -

6. Saintfoin - - - - -	469
7. Bush-Vetch - - - - -	470
8. Burnet - - - - -	471
9. Cichory - - - - -	ib.
10. Spurrey - - - - -	472
11. Tares - - - - -	473

Section IV.

VEGETABLES CALCULATED FOR FODDER - - - - -

1. Jerusalem Artichoke, culture of - - - - -	ib.
2. Common White Beet - -	475
Mangel Wurzel, or Root of Scarcity - - - - -	476

How they may be preserved for winter use -	487
16. Turnips, varieties of - -	ib.
Method of cultivating -	ib.
Diseases of - - - - -	489
Anbury - - - - -	ib.
Black Canker - - -	ib.
The Fly - - - - -	490
Slugs, to destroy - - -	491
Preservation of Turnips for winter use. - - - -	ib.

CHAPTER VIII.

OF THE ECONOMY AND MANAGEMENT OF THE DAIRY.

Section I.

SITUATIONS AND BUILDINGS PROPER FOR A DAIRY.—DAIRY-UTENSILS - - - - -	495
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Section II.

MANAGEMENT OF MILK AND CREAM.—MAKING AND PRESERVATION OF BUTTER.

Proper times of milking cows - - - - -	498
To prevent milk from having a bad taste - - - - -	499
Rules for making Butter - -	509

CONTENTS.

<i>Fresh Butter</i> - - - - -	503
<i>Salt Butter</i> - - - - -	504

Section III.

OF THE MAKING AND PRESERVATION OF CHEESE.

Proper Season for making Cheese - - - - -	505
Preparing the Rennet - - - - -	506
<i>Cheshire Cheese</i> , how made - - - - -	507
<i>Dunlop Cheese</i> - - - - -	509
<i>Gloucester Cheese</i> - - - - -	510
<i>Stilton Cheese</i> - - - - -	<i>ib.</i>
<i>Skim Cheese</i> - - - - -	511
<i>Cream Cheese</i> - - - - -	<i>ib.</i>
<i>Wiltshire Cheese</i> - - - - -	512
<i>Green Cheese</i> - - - - -	<i>ib.</i>
Preservation of Cheese - - - - -	513

rent Sorts, according to their relative fineness - - - - -	524
Result of Lord Somerville's and Dr. Parry's Exertions for the Improvement of British Wool - - - - -	<i>ib.</i>
Qualities necessary to constitute good Wool - - - - -	525
1. Length of Staple - - - - -	526
2. Pliability - - - - -	<i>ib.</i>
3. Felting quality - - - - -	<i>ib.</i>
4. Softness of Pile - - - - -	<i>ib.</i>
5. Specific gravity of the Pile - - - - -	<i>ib.</i>
6. Smell - - - - -	<i>ib.</i>
Table of Breeds of British Sheep, - - - - -	528
Total Value of English Wool - - - - -	530
Observations on its relative fineness - - - - -	531
Principles, for the improvement of Fleeces - - - - -	532
Hints for an improved mode of marking Sheep - - - - -	535

APPENDIX.

I. OF THE DOG.

Shepherd's Dog (with figure) - - - - -	515
Cur Dog (with figure) - - - - -	516
Management of Dogs - - - - -	517
Prussian Mode of treating them - - - - -	<i>ib.</i>

II. OF THE HORSE.

Comparative View of the Different Breeds of Horses - - - - -	518
Breeding of Horses - - - - -	<i>ib.</i>
Colts, treatment of - - - - -	520
Feeding of Horses - - - - -	521
Management of Teams - - - - -	522

III. ON BRITISH WOOL.

<i>Including Hints for the Improvement of its Quality and Quantity.</i> - - - - -	
Importance of the Woollen Manufactures - - - - -	523
Growth of Wool when completed - - - - -	<i>ib.</i>
Classification of Wool, and names appropriated to diffe-	

IV. ASSES—MULES.

Asses - - - - -	539
Mules - - - - -	540

V. POULTRY—RABBITS.

I. LAND-FOWL - - - - -	541
1. <i>Common Fowls</i> , hints for the profitable rearing of - - - - -	541
2. <i>Turkies</i> - - - - -	544
3. <i>Guinea-Fowls</i> - - - - -	545
4. <i>Pigeons</i> - - - - -	<i>ib.</i>
II. WATER-FOWL - - - - -	547
1. <i>Geese</i> - - - - -	<i>ib.</i>
2. <i>Ducks</i> - - - - -	548
Rabbits - - - - -	549

VI. BEES.

Observations on purchasing and removing Bee-Stocks - - - - -	551
Best situations for arranging Bee-Stocks - - - - -	552
Vegetables, most agreeable to Bees - - - - -	<i>ib.</i>
Form of the Hives, and best mode of taking Honey - - - - -	553
Hiving of swarms - - - - -	556
Advantages resulting from the rearing of Bees - - - - -	560

CONTENTS.

VII. FARM ACCOUNTS.		Business to be done in	
Importance of Farm Ac-		October - -	- 567
counts - - - - -	562	November - -	- 568
Plan and Specimens of a		December - -	- <i>ib.</i>
Farmer's Journal - - -	<i>ib.</i>	January - -	- 599
Useful Table for calculating		February - -	- <i>ib.</i>
Wages - - - - -	565	March - -	- <i>ib.</i>
Table for calculating the expense		April - -	- 570
of hoeing, &c. per acre - -	566	May - -	- <i>ib.</i>
		June - -	- <i>ib.</i>
		July - -	- 571
VIII. MONTHLY CALENDAR OF		August - -	- <i>ib.</i>
WORK TO BE DONE THROUGH-		September - -	- <i>ib.</i>
OUT THE YEAR. - - - -	567	Index - - - -	- 573

Directions to the Binder.

Plate I. The Plan of a Farm-yard, to face the Tide.	
— II. of Wheel-carriages, &c.	- p. 239
— III. of Chaff-cutters	- p. 243
— IV. of Mr. Pasmore's Bruising-machine and Straw	
Cutters - - - -	- p. 244
— V. of Mr. Huish's Improved Bee-Hive	- p. 553

INTRODUCTORY VIEW
OF THE
DIFFERENT BREEDS OF CATTLE
REARED IN GREAT BRITAIN.

VARIOUS circumstances have, of late years, combined to render live stock an object of the utmost importance to the farmer; and, notwithstanding the very great advances made in other branches of agriculture, none, perhaps, has undergone a greater change, or has received greater improvement, than the breeding, rearing, and general management of cattle. As these are discussed under their several heads, in the subsequent pages, the editor conceived he might render no unimportant service to the farmer and breeder, by prefixing a concise, yet it is hoped correct, outline of the principal breeds and varieties of breeds, found in this highly-cultivated island. They are accordingly arranged under the several divisions of NEAT CATTLE, SHEEP, HORSES, SWINE.

SECTION I.
NEAT CATTLE.

I. *Wild Race.*

The *specific characters* of this breed, which is generally understood to be the original race of this island, are as follow:—Horns white, tipped with black; colour invariably white; ears, internally and externally, from the tip downwards, about one third red; black muzzles. Its flesh is very fine, and of

excellent flavour. This breed is, at present, only to be found in Chillingham Park, in the county of Northumberland.

II. *Devonshire Breed.*



This breed is descended from the wild race.

Its *specific characters* are:—Horns of a middle length, bending upwards; colour light red, with a light dun ring round the eye; thin face; hips wide; and thin skin. This breed of cattle is most admirably calculated for draught: though rather small in point of size, they amply compensate for that defect by their hardiness and agility. They fatten early. The Devonshire breed derives its name from the county where the cattle are chiefly bred. The figure above delineated, is from an ox belonging to Lord Somerville, and exhibited at his show of cattle, in 1806.



Of this race there are two varieties: 1. The **HEREFORDSHIRE**, and 2. The **SUSSEX**. Their colour is red; hair fine;

thin skin; horns of a medium length, rather curving upwards; head and neck clean; hips, rump, and sirloin wide; thin thighs; back straight; chine narrow; small boned. The animal above delineated has been drawn from a prize ox of that spirited grazier, Mr. Westcar. These two varieties are, in every respect, similar to the parent race:—The cows yield a good portion of rich milk. The Sussex and Hereford breeds occur particularly in the counties whence they are denominated; also in Kent, and various other parts of England.

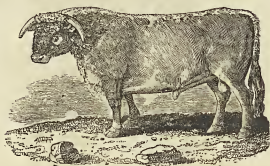
III. *Dutch, or Short-horned Breed.*



Specific characters.—Hides thin; horns short; little hair; colour red and white, nearly equally mixed; tender constitutions. They possess, however, the valuable property of fattening kindly, and yielding large quantities both of milk and

of tallow. The principal resort of this breed is in the eastern counties of England, as well as in some of those in North Britain, which border on the German Ocean.

IV. *Lancashire Breed.*



Specific characters.—Long horned; hides firm and thick; hair long and close; necks thick and coarse; colours various, with a white streak along the back; hoofs large; fore quarters deeply made; hind quarters lighter than those of other breeds. Constitution hardy. Milk less in point of quantity, but the cream is of a richer quality than that of other species of neat cattle. The long-horned cattle are principally reared in Lancashire, Leicestershire, Warwickshire, and the chief grazing counties.

Of this breed, there is a variety, known by the name of DISHLEY, which is descended from that kind selected, improved, and recommended by the late Mr. Bakewell. This variety is in great request in various parts of England: its *specific characters* correspond, in a very great degree, with those of the parent stock; but the leg bones are fine, small, and clean; and the hides are thin. The Dishley neat cattle fatten kindly and in a little time, upon the most valuable points, though yielding but little milk for the dairy, and producing little tallow.

V. *Galloway, or polled.*

This breed derives its name from the county of Galloway, where, and also in some parts of the Lowlands of Scotland, the cattle are chiefly reared; and whence vast numbers are annually sent to Norfolk, and other English counties, to be fattened for the markets. In general they are without horns, though a few beasts sometimes have two small excrescences depending from the parts where horns usually grow, in colour and shape resembling the long-horned race, though somewhat shorter; hides moderately thick. The Galloway is a most excellent and hardy breed, fattening kindly on the best parts; the flesh is fine grained and well mixed with fat; the oxen are well calculated for draught.

Of this breed also there is a variety, termed the **SUFFOLK DUNS**: they are polled, or without horns; small sized, very lean, and big-bellied; colour, a light dun. Suffolk and the adjoining counties contain the largest number of this variety, which is excellently calculated for the dairy, and yields abundance of rich milk. The figure above delineated, was drawn from a Galloway heifer exhibited at Lord Somerville's cattle show, in 1806.

VI. *Highland Breed, or Kyloes.*



Specific characters.—Generally with horns of a middle size, bending upwards; colours various, chiefly black, though sometimes brindled or dun; hair long and close; in other respects not unlike the Galloway breed. In point of advantageous qualities, this breed resembles the preceding species, being eminently calculated for cold, mountainous situations. The Kyloes are reared in the Highlands, or western parts of Scotland; whence great numbers are annually sent to England for sale. There is a variety of this breed, denominated the ISLE OF SKY BREED, from the island where they are principally found: they are of a diminutive size, but in other respects are similar to the Kyloes, both in their specific characters, and also as to their peculiar advantages; they are, however, superior to the Highland race for quick fattening.

VII. *Alderney, or French Breed.*

Specific characters.—Small sized; colour light red or yellow; horns smooth and neat; of tender constitutions. This breed occurs principally in the south of England, in the possession of gentlemen. The Alderney cows are very rich milkers; their flesh is high coloured, fine grained, and of excellent flavour.

The DUNLOP BREED is the produce of a cross of Alderney cows with Fifeshire bulls, and is thus denominated from the parish, or district, where it was first reared. The horns of this race are small, and awkwardly set. The animals are small in size, and of a pied, or sandy-red colour; they are, however, admirably well calculated for the dairy, on account of the richness and quantity of milk afforded by the cows; but not for feeding calves, unless for rearing stock.

VIII. *The Lowland Breed*

is a mixed race, between the Kyloes and Galloways, partly long horned and partly polled; black, brindled, or dun coloured. They are but indifferent for the purposes of the dairy, though they partake of the Galloway kindliness to fatten; on which account large numbers are annually sent from the Lowlands of Scotland into England, to be fattened for the markets.

IX. *Welch Breed.*

Specific characters.—Horns thick, curving upwards; size small; colour chiefly black; bones and shape clean and well proportioned. The Welch cattle are remarkably quick feeders, vigorous, and well calculated for labour, especially the Glamorganshire sort; they are greatly improvable by proper selection and judicious crossing. This race of cattle is bred particularly in the counties of Cardigan and Glamorgan, as well as in other parts of Wales; and especially in the southern and midland English counties, where they are greatly prized.

SECTION II.

S H E E P.

Different Breeds, and varieties of Breeds, of Sheep, both native and foreign, found in Great Britain.

CLASS I.

SHEEP WITHOUT HORNS.

I. *Dishley, or New Leicester Breed.*

Specific characters.—Heads clean, straight, and broad; bodies round, or barrel shaped; eyes fine and lively; bones fine and small; pelts thin; wool long and fine, well calculated for combing, and weighing, upon an average, eight pounds per fleece, when killed at two years old. Fatten kindly and early, being admirably calculated for the market, thriving on pastures that will scarcely keep other sheep, and requiring less food than others. Tolerably hardy and vigorous.

The Dishley sheep are found chiefly in Leicestershire and the neighbouring counties, whence this breed is gradually dispersing through the kingdom.

II. *Lincolnshire.*

Specific characters.—Faces white; bones large; legs white, thick, and rough; carcasses long, thin, and weak; wool fine and long, from ten to eighteen inches, weighing per fleece, when killed at three years, an average of about eleven pounds. Flesh coarse grained. Slow feeders, calculated only for the richest pastures. Constitutions tender. As its name implies, this breed occurs principally in Lincolnshire, and other rich grazing districts.

Variety 1. TEESWATER BREED.

Specific characters.—Bones finer; legs longer; carcase more heavy and firm; back and sides wider than in the original breed; wool not so long as that of the preceding sort, weighing about nine pounds per fleece, when killed at two years old. Flesh finer grained, and fatter than the parent stock. Females singularly prolific, generally producing two, and often three, lambs each. Constitution weak. Slow feeders, suited only for the finest pastures, consequently less profitable than the smaller sized, but quicker feeding sorts of sheep. Capable of great improvement, by crossing with new Leicester, or Dishley rams.

This race is bred chiefly in the extensive, fertile, sheltered, and inclosed tracts of pasture watered by the river Tees, in Yorkshire.

Variety 2. COTSWOLD, OR IMPROVED GLOUCESTER BREED.

Specific characters.—In most respects resembling the parent breed, but superior. They are chiefly found in Gloucestershire. The wool is not so long as that of the original sort. The mutton is fine grained and full sized, and the breed is capable of great improvement by proper crossing.

III. *Dartmoor, or Devonshire Natts.*

Specific characters.—Faces and legs white; necks thick; bones large; backs narrow, but back bone high; sides good.

This race is principally confined to the moor, in the county of Devon, whence the sheep derive their name. The wool is long, weighing upon an average nine pounds, when killed at about two years and a half. This breed improves materially by crossing with the Dishley breed.

IV. *Herefordshire, or Ryelands.*

Specific characters.—Faces and legs white; size small; carcase well shaped; wool very fine and short, growing close to their eyes, and weighing, when killed at four years and a half, upon an average, two pounds per fleece. Patient of hunger. Flesh fine grained. Constitution tender, so as to require to be sheltered in winter. Very profitable, no breed being supposed capable of subsisting on so small a quantity of pasture as this sort requires.

V. *South Down.*



Specific characters.—Faces and legs grey; bones fine; neck long and small; low before; shoulder high; light in the fore quarter; sides broad; loin tolerably good; back bone rather too high; thigh full; and twist good; wool very fine and short, (the staple being from two to three inches in length,) weighing an average of two pounds and a half per fleece, when killed at two years old. Flesh fine grained, and of excellent flavour. Quick feeders. Constitution hardy and vigorous. Capable of great improvement. The South Down sheep are principally bred on the dry, chalky downs of Sussex, whence this valuable breed is gradually being introduced into various districts.

The figure above delineated, is from a South Down ewe, part of Mr. Ellman's stock, exhibited at Lord Somerville's cattle show, in 1806.

Variety. THE CANNOCK HEATH SHEEP,

(which derives its name from Cannock Heath, in the county of Stafford) in most respects resemble the South Down race. The wool is fine and short; the flesh fine and sweet; and the variety is capable of great improvement, by judiciously crossing with Herefordshire rams.

VI. *Romney Marsh.*

Specific characters.—Faces white; legs white and rather long; bones rather large; body round, or barrel shaped; size good; wool fine, long, and white, weighing, when killed at two years and a half, about eight pounds per fleece. Flesh excellent and fine grained. Fatten early and kindly, but are calculated only for rich marsh, or pasture grounds, where this breed is very profitable. This breed of sheep, as the name imports, is reared principally on Romney Marsh, and also on the rich marsh lands of Sussex.

VII. *The Herdwick Breed*

occurs on the mountainous tract at the head of the river Esk and Dudden, in the county of Cumberland, where they are farmed out to herds, from which circumstance they derive their name.

Specific characters.—Faces speckled with black and white; legs of the same colour, small, fine and clean; wool short and matted in the fleece, each fleece weighing upon an average, two pounds, when killed at four years and a half. Constitution very hardy and vigorous, requiring only a little hay during intense winters.

VIII. *The Cheviot Sheep*

derive their name from the mountainous tract termed the Cheviot Hills, whence they have been introduced into the most northern districts.

Specific characters of this breed.—Faces and legs chiefly white; body long; eyes lively and prominent; fore quarter deficient in depth on the breast, which is narrow, as also is the chine; pelts thin; bones fine, clean, and small; wool partly fine, and in part of a coarse quality, each fleece averaging about three pounds, when killed at four years and a half old. A very hardy mountain breed, well calculated for exposed situations, fattening kindly.

IX. *The Dun-faced Breed*

is found in the exposed northern districts of this island. The faces of the sheep are of a dun, or tawny colour. The animals are smaller in size, and have short tails. The wool is variously streaked with black, red, brown, or dun, and partly of a fine texture, weighing about a pound and a half per fleece, when killed at four years and a half. Flesh finely grained, and of excellent flavour. Not so hardy as the preceding sort.

X. *The Shetland Breed*

derives its name from the islands where these sheep are reared. The wool is very fine and soft, fit for the finest manufactures; the fleece weighs upon an average from one to three pounds. The Shetland sheep are very hardy, but too wild to be confined. There are two varieties of this breed: the *first* of which has very coarse wool above, and fine wool below, being supplied with long hairs termed *fors* and *scudda*, which protect the animals from the intense cold of winter. The *second* variety has soft, cottony fleeces, and is less hardy than the preceding variety, the wool being short and open.

CLASS II.

HORNED SHEEP.

XI. *The Exmoor Breed*

derives its name from Exmoor, on and in the vicinity of which, in the northern parts of Devonshire, this race is chiefly found.

Specific characters.—Faces and legs white ; bone, neck, and head peculiarly delicate ; wool fine and long, averaging about four pounds per fleece. Very hardy.

XII. *The Dorsetshire Breed*

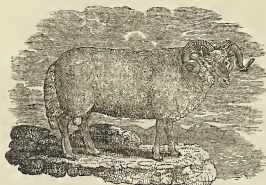
is principally confined to the county of Dorset and the neighbouring districts. The faces are white ; legs long, small, and white ; ewes singularly prolific, bringing lambs twice, and at any part of the year. The wool is fine and short, the fleece averaging about three pounds and a half, when killed at three years and a half old.

XIII. *The Norfolk Sheep*

is indigenous in the counties of Norfolk and Suffolk, where it is now giving way to the more profitable South Down breed.

The horns are large and spiral ; faces black ; bodies long, thin, and weak ; necks long ; legs long, black, or grey. The wool is short and fine, weighing about two pounds per fleece, at three years and a half, which is the chief quality of this breed, whose flesh is well flavoured and of a fine grain. Kept chiefly for the convenience of folding.

XIV. *Heath, Linton, Short, or Forest Sheep.*

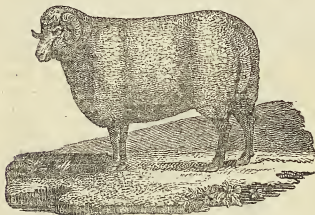


Such are the different names given to the same breed of sheep, which is found in the north-western parts of Yorkshire,

the north-western counties of England, and thence forward to the western Highlands of Scotland.

The specific characters of this race are, horns like those of the preceding sort; faces black or mottled, and legs black; eyes wild and fierce; carcase short and firm; wool long, open, coarse and shaggy; fleece averaging about three pounds and a half at four years and a half. Constitution hardy, and superior to that of the Cheviot breed; admirably calculated for elevated, heathy, and exposed districts. Good feeders. Flesh excellent.

XV. *Merino or Spanish Sheep.*



The horns of this breed are of a middle size, of which the ewes are sometimes destitute; faces white; legs of the same hue, and rather long; shape not very perfect, having a piece of loose skin depending from the neck; bone fine; pelt fine and clear.*

The wool of the Merino Sheep is uncommonly fine, and weighs, upon an average, about three pounds and a half per fleece. The best Merino fleeces have a dark brown tinge on their surface, almost amounting to black, which is formed by dust adhering to the greasy, yolky properties of its pile; and the contrast between it and the rich, white colour within, as well as the rosy hue of the skin, (which peculiarly denotes high proof,) surprise at first sight.† The Merinos are natives of

* Lord Somerville's "System pursued by the Board of Agriculture."

† Somerville's "Facts and Observations on Sheep," &c. p. 21.

Spain, and were first introduced into this country in the year 1787 : but it was not until 1792 that any effectual measures were adopted towards improving our native breeds by a Spanish cross. In the last-mentioned year His MAJESTY received several rams of the Negretti breed ; but so great was the force of prejudice, that, notwithstanding the manufacturers confessed the wool of the Anglo-Spanish cross to be of prime quality, yet not one individual bid for it a price at all equal to what they paid for good Spanish wool. From these sheep imported by his Majesty, and from the great exertions of the Right Hon. Lord Somerville (who at an immense expense and risk imported a flock of choice Merino sheep), the greatest benefit has been derived by crossing this sort with the best British sheep ; although, from a single experiment with the Hereford breed, the produce of the cross is stated, by Mr. Knight, (" Communications to the Board of Agriculture," vol. iii.) to be very ugly, and as he is informed, subject to the foot-rot. The most successful cross, however, has been with the Herefordshire, or Ryeland breed, notwithstanding Mr. K.'s statement, particularly by Dr. Parry, of Bath, whose example has since been followed by numerous wool-growers ; and, from the very superior prices which Anglo-Merino wool produces, and the excellent nature of the cloth manufactured therefrom, the wool of his Merino-ryelands has been proved to equal in fineness that of the best specimens of the native breed. As far as the fourth generation, the characteristic properties of the Merino-ryelands correspond with those of the Spanish race. The fleece is heavier in proportion to the carcase, than that of any other known breed in Europe. The average weight of the fleeces of two-shear ewes is estimated at four pounds and a half avoirdupoise, in an unwashed state ; the fleece of a fat wether of the same age will be from five to seven pounds.* The figure at the head of this breed is that of a Merino wether, belonging to Lord Somerville. Merinos, and Sheep of Merino crosses, have within the last few years become pretty frequent ; and have been successfully introduced into Scotland, and also into the United States of America.

* "Facts and Observations on British Wool," 4to. 1799, pp. 4, 5.—Further particulars respecting the exertions of Dr. Parry and Lord Somerville, are detailed in the appendix (No. iii.) to this Work.

SECT. III.

HORSES.

IN selecting horses for agricultural purposes, the points demanding attention are strength, activity, hardiness, and true draught;—properties these, which are found to concentrate only in the Clydesdale or Lanerkshire breed, in the Cleveland bays, and Suffolk punches. To these breeds, therefore, we shall, in the present sketch, confine our attention.

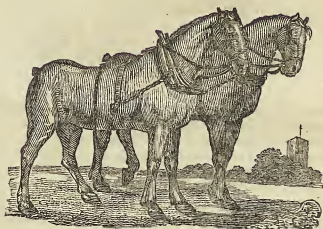
I. *Clydesdale Horses.*

This breed is strong, hardy, active, and eminently calculated for hilly districts. The colour is generally brown or grey; the legs are sinewy and clean; the eyes sprightly and animated; the head and body light and well formed; from fifteen to sixteen hands and a half in height.

II. *The Cleveland Bays*

are bred in various parts of Durham and Northumberland, and particularly in the district of Cleveland, Yorkshire, whence they have received their name. They are of a large size, and in point of activity, hardiness, and strength, superior to most kinds of horses. They are well formed, and, for the most part, of a bay colour.*

* Culley on Live Stock.

III. *Suffolk Punches,*

or, Suffolk Punch Sorrels, as they are also termed, are singularly useful for those departments of agriculture which may require the labour of horses. The sandy tract of land in the vicinity of Woodbridge, Suffolk, has long been celebrated for the production of this breed, which is generally allowed to afford the best cart-horses in England. The Suffolk Punches are of a bright sorrel colour; have very low foreheads; large bodies, somewhat similar to those of cows; short legs; and ill-formed heads: but, notwithstanding their awkward appearance, they exceed every other race of horses in draught. They are of various sizes: but the smaller ones (fourteen hands and a half high; which cost about £40 or £50 per pair) are found; in general, to be the most serviceable.

The figures above given were drawn from two capital Punches, which belonged to that eminent farmer Mr. Wakefield, late of Burnham Wyck, in the county of Essex.

IV. *The old English Draught Horse*

is remarkable for its beauty, symmetry of form, and large size. Possessing singular strength for draught, this race is in high request in the counties of Leicester, Northampton, Lincoln, and a few other shires to which they are suited, and affords an ample source of profit to graziers and breeders. This breed possesses strength of constitution, hardiness, and bone in such a superior degree, that, as every attention is paid to the corresponding points both in sires and dams, these horses produce very handsome prices. They come into use, in general, at two years old, or under; and if brought to a good size in proper time, from thirty to fifty pounds, or guineas, are often given at two and three years old. The figure above given represents an improved cart-horse of the native English breed.

The following hints, relative to the age of these useful animals, and the essential characteristics of a good horse, may not improperly conclude the present outline.—In old horses, the eye-pits are generally deep; though this mark is very uncertain, as it also occurs in young horses that are descended from aged stallions. But the most certain criterion is that derived from the teeth, the number of which amounts to forty; namely, twenty-four grinders or double teeth (which in fact afford no certain guide), and sixteen others, viz. four tushes or tusks, and twelve fore-teeth: these last are the surest guides for discovering the age of a horse. As mares usually have no tusks, their teeth

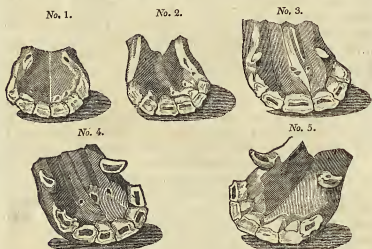
are only thirty-six. A colt is foaled without teeth; in a few days he puts out four, which are called pincers, or nippers; soon after appear the four separators; next to the pincers, it is sometimes three or four months before the next, called corner teeth, push forth. These twelve colt's teeth, in the front of the mouth, continue, without alteration, till the colt is two years or two years and a half old, which makes it difficult, without great care, to avoid being imposed on during that interval, if the seller finds it his interest to make the colt pass for either younger or older than he really is: the only rule you have then to judge by is his coat, and the hairs of his mane and tail. A colt of one year has a supple, rough coat, resembling that of a water-spaniel, and the hair of his mane and tail feels like flax, and hangs like a rope untwisted: whereas a colt of two years has a flat coat, and straight ears like a grown horse.

At about two years and a half old, sometimes sooner, sometimes later, according as he has been fed, a horse begins to change his teeth. The pincers which come the first, are also the first that fall; so that at three years he has four horse's, and eight colt's teeth, which are easily known apart, the former being larger, flatter, and yellower, than the other, and streaked from the end quite into the gums.

These four horse pincers have, in the middle of their extremities, a black hole; very deep; whereas those of the colt are round and white. When the horse is coming four years old, he loses his four separators, or middle teeth, and puts forth four others, which follow the same rule as the pincers. He has now eight horse's teeth and four colt's. At five years old he sheds the four corner, which are his last colt's teeth, and is called a horse.

During this year also, his four tusks (which are chiefly peculiar to horses) come behind the others; the lower ones often four months before the upper; but whatever may be the common opinion, a horse that has the two lower tusks, if he has not the upper, may be judged to be under five years old, unless the other teeth show the contrary; for some horses that live to be very old never have any upper tusks at all. The two lower tusks are one of the most certain rules that a horse is coming five years old, notwithstanding his colt's teeth may not be all gone.

Figure 1 of the annexed engravings of the horse's teeth, represents them at 2 years and a half old; fig. 2, at 3 years old; fig. 3, at 4 years; fig. 4, at 5 years; and fig. 5, at 6 years.



It is not an unfrequent practice of jockies and breeders, in order to make their colts seem five years old, when they are but four, to pull out their last colt's teeth; but if all the colt's teeth be gone, and no tusks appear, the purchaser may be certain this trick has been played: another artifice they use, is to beat the bars every day with a wooden mallet, in the place where the tusks are to appear, in order to make them seem hard, as if the tusks were just ready to cut.

When a horse is coming six years old, the two lower pincers fill up, and instead of the holes above mentioned, show only a black spot. Betwixt six and seven the two middle teeth fill up in the same manner; and between seven and eight the corner teeth do the like; after which it is said to be impossible to know certainly the age of a horse, he having no longer any mark in the mouth. In this case recourse can only be had to the tusks, and the situation of the teeth.

With respect to the tusks, the purchaser must with his finger feel the inside of them from the point quite to the gum. If the tusk be pointed flat, and have two little channels within side, he may be certain the horse is not old, and at the utmost only coming ten. Between eleven and twelve the two channels are

reduced to one, which after twelve entirely disappears, and the tusks are as round within as they are without; he has no guide then but the situation of the teeth. The longest teeth are not always a sign of the greatest age, but their hanging over and pushing forward, as also their meeting perpendicularly, is a certain token of youth.

Many persons, whilst they see certain little holes in the middle of the teeth, imagine that such horses are but in their seventh year, without regard to the situation the teeth take as they grow old.

When horses are young, their teeth meet perpendicularly, but grow longer and push forward with age; besides, the mouth of a young horse is very fleshy within in the palate, and his lips are firm and hard: on the contrary, the inside of an old horse's mouth is lean both above and below, and seems to have only the skin upon the bones. The lips are soft and easy to turn up with the hand.

All horses are marked in the same manner, but some naturally and others artificially. The natural mark is called begue; and some ignorant persons imagine such horses are marked all their lives; because for many years they find a little hole, or a kind of void in the middle of the separators and corner teeth; but when the tusks are grown round, as well within as without, and the teeth point forward, there is room to conjecture, in proportion as they advance from year to year, what the horse's age may be, without regarding the cavity above mentioned.

This artificial manner is made use of by dealers and jockies, who mark their horses after the age of being known, to make them appear only six or seven years old. They do it in this manner: they throw down the horse to have him more at command, and, with a steel graver, like what is used for ivory, hollow the middle teeth a little, and the corner ones somewhat more; then fill the holes with a little rosin, pitch, sulphur, or some grains of wheat, which they burn in with a bit of hot wire, made in proportion to the hole. This operation they repeat from time to time, till they give the hole a lasting black, in imitation of nature; but notwithstanding this fraudulent attempt, the hot iron makes a little yellowish circle round the holes like that which it would leave upon ivory; they have therefore another trick to prevent detection, which is to make the horse foam from time to time, after having rubbed his mouth, lips, and

gums with salt, and crumbs of bread dried and powdered with salt. This foam hides the circle made by the iron.

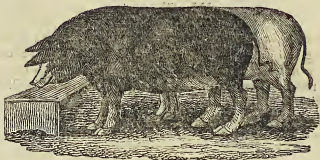
Another thing which they cannot accomplish, is to counterfeited young tusks, it being out of their power to make those two crannies above mentioned, which are given by nature; with files they make them sharper or flatter, but then they take away the shining natural enamel, so that one may always know, by these tusks, horses that are past seven, till they come to twelve or thirteen. The figures prefixed to these remarks on horses' teeth, in page 20, will illustrate the preceding hints; being drawn from the teeth themselves, at the various ages therein specified.

With regard to the circumstances indicating a sound horse, it may be observed, that where a horse is free from blemish, the legs and thighs are well shaped; the knees straight; the skin and shanks thin; the back sinews strong and firm. The pastern joints should be small and taper, and the hock lean, dry, and not puffed up with wind. With respect to the hoof itself, the coronet ought to be thick, without any tumour, or swelling; the horn bright, and of a greyish colour. The fibres of a strong foot appear very distinctly, running in a direct line from the coronet to the toe, like the grain of wood. Such a foot, however, ought to be kept moist and pliable; as it is subject to fissures and cracks, by which the hoof is sometimes cleft through the whole length of the coronet. A narrow heel is likewise a great defect; and, if it do not exceed two fingers in breadth, it forms an imperfect foot. A high heel often causes a horse to trip or stumble; while a low one, with long yielding pasterns, is apt to be worn away on a long journey. On the other hand, a foot disproportionately large, renders the animal weak, and clumsy in its gait.

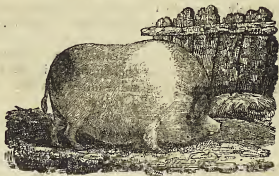
The head of a horse ought to be small, and rather lean than fleshy; his ears should be erect, thin, sprightly, and pointed; the neck arched towards the middle, tapering gradually towards the head; the shoulders rather long; the withers thin, and enlarge by degrees as they extend downwards, yet so as to render his breast neither too gross nor too narrow. Such are the principal characters by which the best form and proportion of that useful animal may be determined.

SECTION IV.

SWINE.

I. *Berkshire Breed.*

Specific characters, &c.—Colour reddish, with brown or black spots; sides very broad; short legs; ears large, and pendant over the eyes; body thick, close, and well made. Kindly disposed to fatten, and attaining a large size, but can be kept only where a large and constant supply of food can be procured, otherwise they will dwindle away, and yield no profit. Flesh fine.—The animals from which the above figures were drawn, were bred by Sir William Curtis, and exhibited at Lord Somerville's Cattle Show in 1807; where they attracted general admiration, for their lively activity, and excellent condition.

II. *Chinese, or Black Breed.*

Specific characters, &c.—Colour mostly black, though sometimes white, tawny or reddish, and brown; size small; neck

thick; legs short; body thick, close, and well made. One of the most profitable sorts in this island; flesh delicate; fatten kindly on very indifferent food; but very mischievous if not well ringed.

III. Gloucester.

Specific characters, &c.—Colour white; size large; legs long, having two wattles or dugs pendant from the throat; carcase long and thin; skin thinner than that of the Berkshire sort; ill formed. A very unprofitable sort; found chiefly in Gloucestershire, Shropshire, and West Devon; supposed to have formerly been the only breed in Britain. Do not fatten so well, or so kindly, as the Berkshire breed.

IV. Hampshire.

Specific characters, &c.—Colour chiefly white; neck and carcase long; body not so well formed as the Berkshire pigs; size large. Fatten kindly, and to a very great size and weight.

V. Highland, or Irish Breed.

Specific characters, &c.—Size small; bristles erect; ill shaped. Thrive very badly; prevailing chiefly in the Highlands.

VI. Northampton Breed.

Specific characters, &c.—Colour white; legs very short; ears enormously large, often sweeping the ground; size large. Fatten to a large size, but not very kindly; reared chiefly in the county of Northampton.

The SHROPSHIRE BREED appears to be a variety of the Northampton race, to whose characteristics it bears a great resemblance. The Shropshire swine fatten to a large size, but are not so kindly disposed as the Berkshire.

VII. The Rudgwick Breed

is a peculiar sort of swine, reared at a village of the same name, on the confines of Surry and Sussex. These swine are very valuable, as they fatten kindly and to a vast size, weighing,

at two years, twice or thrice the weight of other swine at that age.

VIII. *Swing-tailed Breed.*

The colour of this breed is various; its size small, but well proportioned. They are hardy, and fatten to a great weight.

IX. *Large, spotted Woburn Breed.*



This is a new variety, introduced by the late Duke of Bedford; its size is large, and colour various. These swine are well formed, very prolific, hardy, kindly disposed to fatten, attaining nearly twice the size and weight of other hogs within the same given period of time. The animal, whence our figure was drawn, was exhibited at Lord Somerville's cattle-show, in March 1806.

THE
COMPLETE GRAZIER,

&c. &c.

CHAP. I.

ON THE CHOICE AND TREATMENT OF CATTLE.

OF the various sources which compose the wealth of nations, there are few, perhaps, of greater moment, or which have a superior claim to attention, than that branch of rural economy which is the subject of the following pages. In fact, when it is considered, that not only the servants of a farmer, but also his cattle, are *productive* labourers; when we recollect the stimulus to industry, as well as the rapid circulation of capital which the farmer occasions, by furnishing constant employment to the numerous artificers, who are occupied in manufacturing implements which are indispensably necessary to him; further, when we call to mind the immense mass of materials which his *productive* labour supplies for the purposes of commercial intercourse, and especially the influence produced by that labour on the comfort and appearance of towns, whose inhabitants must otherwise be destitute of the necessaries of life; when all these diversified circumstances are taken into consideration, every reflecting inquirer must acknowledge, that of all the ways in which a capital can be employed, this is by far the most advantageous to society.

Justly, therefore, has it been remarked,* that "the capital employed in agriculture not only puts into motion a greater quantity of productive labour than any equal capital employed in manufactures, but, also in proportion to the quantity of productive labour which it employs, it adds a much greater value to the annual produce of the land and labour of the country, while it increases the real wealth and revenue of its inhabitants."

SECTION I.

General Observations on buying and stocking a Farm with Cattle.

"THE benefit," observes that enlightened agriculturist, Mr. Young,† "to be derived from the occupation of land, depends so much on the farmer commanding the requisite capital, that it is extremely necessary for the young beginner to be well advised on this essential point." Assuming it therefore as certain, that such a beginner is provided with that indispensable requisite, we shall proceed to state a few general hints on the buying and stocking of his farm with cattle; and shall introduce, under the respective accounts of rearing and breeding the different species, such remarks on their various merits and demerits as will materially assist him in the course of his labours.

The first object of attention, then, is to consider the proportion between his stock and the quantity of feed which will be necessary to support them. The nature, situation, and fertility of the soils that compose his farm are equally worthy of notice, as well as the purpose for which he designs more particularly to rear or feed his cattle; whether for the pail, or with the view of supplying the markets. In fact, it will be expedient to observe the greatest exactness in this proportion; because, in case he should overstock his land, his loss will be certain and great; while, on the other hand, he will incur a diminution in his profit, if he should not stock his land with as many cattle as it will bear.

Formerly, a great prejudice prevailed in favour of big-boned, large beasts, but it has been ascertained, that this breed is, in

* Smith's Wealth of Nations, vol. ii. p. 53, 4th Edit.

† Farmer's Calendar, Ed. of 1804, p. 481.

point of profit, much inferior to the middle-sized kind; and, by a careful attention to the selection of stock, no inconsiderable progress may be made towards the improvement of the different species. Among the various professional breeders of modern times, few have attained greater celebrity than the late Mr. Bakewell, of Dishley, to whom we are indebted for many new and important improvements in the science of rearing cattle. The principle which he invariably adopted was, to select the best beast, that would weigh most in the valuable joints; so that, while he gained in point of shape, he also acquired a more hardy breed; and, especially by attending to the *kindliness* of their skin, he became possessed of a race which was more easily fed and fattened than any other.

Till within a few years, the invariable practice was to judge by the *eye* only, without regarding the other qualities of the animal intended to be purchased; but, in the present improved age, a more rational mode of forming the judgment is adopted. The sense of touch is now brought in aid of the sight; and, by repeated practice, the art of judging of the *kindliness* to fatten has been brought to such perfection, that any well-informed breeder, who has *personal* experience can, on examining lean beasts, tell, almost instantaneously, in what points or parts they will or will not fatten.

In the selection, therefore, of live stock in general, the young farmer will find it necessary attentively to consider the following particulars:

- I. *Beauty, or symmetry of shape*; in which the form is so compact, that every part of the animal bears an exact consistency, while the carcase should be deep and broad, and the less valuable parts (such as the head, bones, &c.) ought to be as small as possible.* For working cattle more particularly, Mr. Marshall states the following proportions as being essentially necessary, viz. That the neck be thin and clean, to lighten the fore-end as well as to lessen the collar, and make it sit close and easily on the animal while employed in draught. The carcase should be large, the bosom broad, and chest deep; the ribs standing out from the spine,

* Sir John Sinclair's "Hints regarding Cattle," in the Farmer's Magazine, vol. iii. p. 154.

both to give strength of frame and constitution, and likewise to admit of the intestines being lodged within the ribs. Further, the shoulders ought not only to be light of bone and rounded off at the lower point, that the collar may sit easily, but also broad, to impart strength; and well covered with flesh, that the animal may draw with greater ease, as well as to furnish a desired point of fattening cattle. The back also ought to be wide and level throughout; the quarters long, the thighs thin, and narrow at the round bone. The legs ought, below the knee and hock, to be straight, and of a moderate length; light boned; clean from fleshiness, yet having joints and sinews of a moderate size, for the united purposes of strength and activity. In these points all intelligent breeders concur; but, as beauty of shape too often depends on the caprice of fashion, it is more requisite to regard,

II. *Utility of form*, or that nice proportion of the parts to which Mr. Bakewell bestowed so much attention, and which has already been noticed.

III. The *flesh*, or texture of the muscular parts; a quality which was formerly noticed only by butchers, but the knowledge of which the enlightened farmers or breeders of the present day, have not blushed to acquire from them: although this quality necessarily varies according to the age and size of cattle, yet it may be greatly regulated by attention to the food employed for fattening them. As a knowledge of this requisite can only be acquired by practice, it is sufficient to state, that the best sign of good flesh is that of being *marbled*, or having the fat and lean finely veined, or intermixed, when the animals are killed; and, while alive, by a firm and mellow feel.

IV. In rearing live stock of any description, it should be an invariable rule to breed from small-boned, straight-backed, healthy, clean, kindly-skinned,* round-bodied, and barrel-shaped animals, with clean necks and throats, and little

* As this word may probably often appear in the course of the subsequent pages, it may not be altogether irrelevant to state, that it implies a skin which feels *mellow*, i. e. soft, yet firm to the touch; and which is equally distant from the hard, dry skin, peculiar to some cattle, as it is from the loose and flabby feel of others.

or no dewlap; carefully rejecting all those which may have heavy legs and *roach* backs, together with much appearance of offal. And, as some breeds have a tendency to generate great quantities of fat on certain parts of the body, while in others it is more mixed with the flesh of every part of the animal, this circumstance will claim the attention of the breeder as he advances in business.

V. In the purchasing of cattle, whether in a lean or fat state, the farmer should on no account buy beasts out of richer or better grounds than those into which he intends to turn them; for, in this case, he must inevitably sustain a very material loss, by the cattle not thriving, particularly if they be old. It will, therefore, be advisable to select them, either from stock feeding in the neighbourhood, or from such breeds as are best adapted to the nature and situation of the soil.

VI. *Docility of disposition*, without being deficient in spirit, is of equal moment; for, independently of the damage committed by cattle of wild tempers on fences, fields, &c. which inconvenience will thus be obviated; it is an indisputable fact, that *tame beasts require less food to rear, support, and fatten them*, consequently every attention ought to be paid, early to accustom them to be docile and familiar.

VII. *Hardiness of constitution*, particularly in bleak and exposed districts, is indeed a most important requisite; and, in every case, it is highly essential to a farmer's interest to have a breed that is liable neither to disease nor to any hereditary distemper. A dark colour, and in cattle which are kept out all the winter, a rough and curled *pile* or coat of hair, are, in the popular estimation, certain indications of hardiness; but it is obvious to every thinking person, that this quality, though in some respects inherent in particular breeds, depends, in a great measure, upon the method in which cattle are treated.

VIII. Connected with hardiness of constitution is *early maturity*, which, however, can only be attained by feeding cattle in such a manner as to keep them constantly in a growing state. By an observance of this principle, it has been found that beasts and sheep, thus managed, *thrive more in three years*, than they usually do in *five*, when they have

not sufficient food during the winter, by which, in the common mode of rearing, their growth is checked.

IX. A *kindly disposition* to take fat on the most valuable parts of the carcase, at an early age, and with little food, when compared with the quantity and quality consumed in less fertile situations, by which means the supply will be greater for the consumer. On this account, smaller cattle are recommended by C. G. Grey, Esq. ("Letters and Papers of the Bath and West of England Society," vol. x. p. 262,) as generally having a more natural disposition to fatten, and as requiring, proportionably to the larger animal, less food to make them fat; consequently, the greater quantity of meat for consumption can be made per acre. "In stall-feeding," the nature, method, and advantages of which will be stated in a subsequent chapter,* he remarks that, "whatever may be the food, the smaller animal pays most for that food. In dry lands, the smaller animal is always sufficiently heavy for treading; in wet lands less injurious." And as to milk, he is decisively of opinion, that the smaller animal produces more goods for the food she consumes, than those of a larger size.

X. *The hide* of cattle is also worthy of notice; as, by the simple touch, both butchers and graziers are enabled to judge of their disposition to fatten. Sir John Sinclair has justly remarked,† that, "when the hide or skin feels soft and silky, it strongly indicates a tendency in the animal to take on meat; and it is evident, that a fine and soft skin must be more pliable, and more easily stretched out to receive any extraordinary quantity of flesh than a thick or tough one. At the same time, thick hides are of great importance in various manufactures. Indeed, they are necessary in cold countries, where cattle are much exposed to the inclemency of the seasons; and, in the best breeds of Highland cattle, the skin is thick in proportion to their size, without being so tough as to be prejudicial to their capacity of fattening."

XI. *Working*, or an aptitude for labour: a point of infinite importance in a country whose population is so extensive

* Chap. III. Sect. II.

† "Hints regarding Cattle," p. 157, &c.

as that of Britain, and where the consumption of grain by horses has so material an influence on the comforts and existence of the inhabitants. As, however, there is a difference of opinion on this subject, the reader is referred to the fifth section of this chapter, where the question is fully discussed.

XII. Whether kine be purchased for the plough, or for the purpose of fattening, in addition to the essentials already stated, it will be necessary to see that they are young, in perfect health, full-mouthed, and not broken either in tail, hair, or pizzle; that the hair *stare* not, and that they are not hide-bound, otherwise they will not feed kindly. The same remark is applicable to cows intended for the pail, the horns of which should be fair and smooth, the forehead broad and smooth, udders white, yet not fleshy, but thin and loose when empty, to hold the greater quantity of milk, but large when full; provided with large dug-veins to fill it, and with four long, elastic teats, in order that the milk may be more easily drawn off.

XIII. *Age*.—Beside the rules above stated, there are some particulars with regard to the age of neat or black cattle and sheep, which will merit the farmer's consideration.

"Sheep, in general, renew their first two teeth from fourteen to sixteen months old, and afterwards every year, about the same time, until they are turned three years old, or rather *three shear*, to speak technically, when they become full-mouthed; for, though they have eight teeth in the under jaw before, I believe they only cast or renew the six inside ones."* But, with regard to this point, there is a difference of opinion among experienced shepherds, some of whom conceive that they cast only six, while others think they renew the whole eight fore-teeth.

"Neat cattle cast no teeth until turned two years old, when they get two new teeth; at three they get two more; and in every succeeding year get two, until five years old, when they are called *full-mouthed*, though they are not properly full-mouthed until six years old, because the two corner teeth,

which are last in renewing, are not perfectly up until they are six.”*

The horns of neat cattle also supply another criterion by which the judgment may be assisted, after the signs afforded by the teeth become uncertain. When three years old, their horns are smooth and handsome; after which period there appears a circle, or wrinkle, which is annually increased as long as the horn remains; so that, according to the number of these circles or rings, the age of a beast may be ascertained with tolerable precision, unless such wrinkles are defaced, or artificially removed, by scraping or filing; a fraudulent practice, which is but too frequently adopted, in order to deceive the ignorant or inexperienced purchaser with respect to the real age of the animal.

SECTION II.

Sketch of the Natural History of the Bull, together with a Comparative View of the different Breeds of Black Cattle.

In the preceding section, some general remarks on the purchasing of cattle have been given, and a few characteristic features have been pointed out, in order to assist the young adventurer in this branch of rural economy. But, as the *male* of every species is the principal in the breed and generation, it will not be useless to give an account of that form or shape which is so essential to the constituting of a perfect animal.

A bull, then, ought to be the most handsome of his kind: he should be tall and well made; his head should be rather long; and, as it is designed by nature to be the chief instrument both of offence and of defence, it ought to present every mark of strength; his horns rather long, clean, and bright; his large black eyes lively and protuberant; his forehead broad and close set, with short, curled hair; his ears long and thin, hairy within and without; muzzle fine; nostrils wide and open; neck strong and muscular, not incumbered with a coarse, wreathy skin, but firm, rising with a gentle curve from the shoulders, tapering to the part where it is connected with the head; dewlap large, thin, and hairy. Further, his shoulders should be deep, high,

* Culley on Live Stock, p. 208, 209.

and moderately broad at the top; the bosom open; breast large, and projecting well before his legs; back straight and broad, even to the setting-on of the tail, which should not extend far up the roof, but be strong and deep, with much lank hair on the under part of it; ribs broad and circular, rising one above another, so that the last rib shall be rather the highest; the fore thighs strong and muscular, tapering gradually to the knees; the belly deep, straight, and also tapering a little to the hind thighs, which should be large and square; the roof wide, particularly over the chine and *hips*, or *hooks*; the legs straight, short jointed, full of sinews, clean and fine boned; knees round, big, and straight; feet distant one from another, not broad, nor turning in, but easily spreading; hoofs long and hollow; the hide not hard, or stubborn to the touch; the hair uniformly thick, short, curled, and of a soft texture; and the body long, deep, and round, filling well up to the shoulder and into the groin, so as to form what has not improperly been termed a round, or *barrel-like* carcass.

The bull attains the age of puberty generally at the end of from twelve months to two years; but it is advisable to restrain him from the propagation of his species until he has arrived at his full growth, which is about four years; for, if this animal be suffered to breed earlier than three years, the stock is liable to degenerate. Nor ought more than twenty cows to be allotted to one bull, or this animal be permitted to serve more than two cows in one day.

The bull, as well as the cow and ox, generally lives about fourteen years; but the progress of decay is usually perceptible after he has attained the age of ten years. His temper is naturally fierce and ungovernable, which is not a little increased by his being permitted to live quietly in the best pastures, without being applied to any useful purpose but that of propagating his species. Hence this animal, naturally vicious, often becomes so mischievous as to endanger many valuable lives; an evil which, we conceive, might be remedied by training him to labour. For, being the only beast of his size which is thus indulged in idleness, and as he possesses equal strength with the ox, we doubt not but if he were moderately worked, and allowed to indulge his desires during the breeding season, he would, by being inured to labour, and attended by mankind, become gradually tame, and harmless as the horse,

or any other often naturally vicious animal. Several experiments, indeed, have been made for this purpose; and, from their successful result, we think the practice of working bulls may be advantageously adopted; especially as these animals are not only broken in with little difficulty, and work well, but also because they recover from fatigue much sooner than any ox, and may generally be procured at easy prices in those places, where, oxen being scarce, a young farmer cannot purchase without involving himself in great expense.

For the prevention of accidents from mischievous bulls, an ingenious and simple contrivance has been suggested by Henry James Nicholls, Esq. of Woodhall, near Wisbeach, on whom the Society for the Encouragement of Arts, Agriculture, &c. in 1815 conferred a premium of ten guineas, for his invention. Of its form and application the following engravings will convey a correct idea:

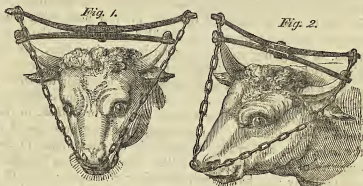


Fig. 1. Represents a *front* view of the apparatus, as affixed to the head of the animal. It consists of a straight piece of wood or iron (the latter is the preferable material) stretching from horn to horn, perforated at each end so as to pass over the tips, and fastened on them by the usual metal nuts. On the centre of this is rivetted a *curved bar of iron*, bending upwards, which moves easily on the rivet, and has holes at each end containing the upper round link of a chain. These chains again unite in a strong iron ring, which opens by a hinge and screw, and passes through the bull's nose. The effect of this contrivance is as follows:—any person seeing a vicious animal approach may easily avoid him; but if the beast should make

a push *forward*, the curved iron bar will prevent any bad consequences: and if he move in the smallest degree to the *right* or to the *left*, the bar communicating by the chain with the ring upon his nose, will bring him immediately to check. This *lateral* operation is delineated in Fig. 2. An additional advantage resulting from the use of this invention is, that a beast may, with the smallest power, be led in any direction.

From the introductory view of the various breeds of cattle prefixed to this work, the reader will probably be enabled to form some estimate of the value of the respective breeds therein described; the two kinds, however, which are chiefly reared, are the *long-horned* and the *short-horned* cattle; and, concerning their merits and demerits, there has long been a difference of opinion among the most experienced breeders. It may not, therefore, be altogether useless to offer a few comparative remarks to the consideration of the young grazier. "The long horns excel in the thickness and firm texture of the hides, in the length and closeness of the hair, in their beef being finer grained and more mixed and marbled than that of the short horns, in weighing more in proportion to their size, and in giving richer milk; but they are inferior to the short horns, in giving a less quantity of milk, in weighing less upon the whole, in affording less tallow when killed, in being slower feeders, and of a coarser make, and more *leathery* or *bullish*, in the under side of the neck. In few words, the long horns excel in the hide, hair, and quality of the beef; the short horns in the quantity of beef, tallow, and milk. Each breed has long had, and probably may have, their particular advocates; but, if I may hazard a conjecture, is it not probable that both kinds may have their particular advantages in different situations? Why may not the thick firm hides, and long close-set hair of the one kind, be a protection and security against those impetuous winds and heavy rains to which the west coast of this island is so subject; while the more regular seasons and mild climate, upon the east coast, are more suitable to the constitutions of the short horn?"*

It should, however, be understood, that the preference above given by Mr. C. to the long-horned species, on account of the superior quality of their beef, applies only to the variety of that

* Culley on Live Stock, p. 80.

breed which was selected, improved, and recommended by the late eminent Mr. Bakewell, and which is described in the introductory view already referred to, under the name of the *Dishley breed*. In fact, Mr. C. is of opinion that the beef of the short-horned race is, in general, superior to that of the common long-horned sort; though he has little doubt but "a breed of short-horned cattle might be selected, *equal*, if not *superior*, even to that very *kindly-fleshed* sort of Mr. Bakewell's, provided any able breeder, or body of breeders, would pay as much attention to these as Mr. Bakewell and his neighbours have done to the short horns."⁴

That consideration, which this important subject requires, has of late years been amply bestowed upon the improvement of British cattle; and beside the respectable breeder above mentioned, the labours of the late and present Duke of Bedford, of the late Mr. Fowler,† as well as of the various excellent societies established in many parts of Britain for this public-spirited purpose,—to omit the numerous private individuals who have recently applied themselves to this branch of rural science,—all these must claim the gratitude and good wishes of every real friend to his country.

But, though the short and long-horned cattle have hitherto almost exclusively occupied the attention of breeders, it is evident, that there are other varieties, or species, which might be introduced with greater advantage in many situations.

* Culley on Live Stock, p. 81.

† Of Little Rollright, in the county of Oxford, whose stock was sold by auction, in the month of March, 1791. Few exhibitions could be more enchanting than the picturesque view presented by these beautiful animals, at the sale of which the most respectable farmers were present, many of whom had travelled several hundred miles, from almost every part of Britain; and the prices given for which are almost incredible. Let it suffice to say, that fifteen prime head of cattle, five bulls and ten cows, were sold for various sums, amounting to £. 2,464; or, upon an average, at £. 164 each. The finest bull, named *Sultan*, only two years old, produced *two hundred and ten guineas*; *Washington*, another of the same age, was sold for *two hundred and five guineas*; while *Brindled Beauty*, a cow, brought the sum of *two hundred and sixty guineas*; and, at a subsequent sale of Mr. Paget's stock, in November 1793, *Shakespeare*, a bull bred by Mr. Fowler, was disposed of for the enormous sum of *four hundred guineas*!!!—So great, indeed, was Mr. F.'s deserved reputation, that the Great Frederic, king of Prussia, conferred on him a gold medal, and honoured him with his correspondence.

Such, for instance, are the *Highland* breed, or *Kylves*, and its variety, the *Isle of Sky* cattle, which are singularly well adapted to cold, exposed and heathy, mountainous parts; such also are the *Galloway*, and its variety, the *Suffolk duns*. These beasts have acquired great reputation at Smithfield market for the excellence of their marbled flesh; a quality which is materially increased by their quick feeding, and kindliness to fatten.

It has already been hinted, when discussing the subject of buying cattle, that it will be advisable to select them, either from stock feeding in the neighbourhood, or from those sorts which are best calculated for the nature and situation of the soil. This remark should be constantly kept in view, with regard to the breeding of cattle; let, therefore, that breed which is most profitable and best suited to the situation of the farm, first be ascertained; and, having succeeded in this desirable object, let it be the breeder's study to improve that sort to the utmost, by selecting and breeding from those, which to beauty of form unite the more essential qualities of possessing *kindly* skins, and of weighing most in the valuable parts, together with a disposition to lay fat on the best points, as well as to fatten in a short period of time.

Before we conclude this subject, it may not be amiss to notice the neat cattle reared in the sister island. Few countries are, perhaps, so well situated for the breeding of cattle of every description; and it is in consequence of this peculiar felicity of situation, that our fleets are supplied with the immense quantities of prime beef necessary for the support of their crews.

The breed of Irish cattle, of which many thousand carcasses are annually exported, is distinguished by little variety, excepting that which necessarily arises from the difference of situation. They are remarkable for the strength of their constitution; and appear to be a mixed race, between the long-horned breed and the Scotch or Welch cattle. The counties of Roscommon, Limerick, Cork, and Tipperary, are chiefly celebrated for the vast herds of cattle which are there annually bred and slaughtered for exportation; and many of the most public-spirited breeders have, of late years, incurred very considerable expense by purchasing prime, long-horned stock from England, for the purpose of improving their breeds: a measure that has already been attended with the most beneficial effects,

and which will doubtless, in the course of a few years, prove a source of great wealth to that island.

SECTION III.

Of the Cow.

THE value of the respective breeds of milch kine having already been stated, it will rest with the farmer to make his selection according to the nature of the soil, and to choose such cows as are nearly of the same colour, and of the same country as the bull. It may not, however, be amiss to remark that, in the vicinity of the metropolis, the large Holderness or short-horned breed chiefly prevails; although there are considerable numbers of the Suffolk, polled or Galloway, Devon, and Alderney breeds. And since, in order to manage the business of a milk-farmer with success, near large cities or towns, it is essential to procure such cows as will, under all circumstances, produce most milk according to the food they consume, the practice of the southern counties may afford some criterion for other districts. Thus, as the first-mentioned breed of cows (the Holderness) requires rich and succulent food, they may be kept with profit in those places where it can be procured. On the contrary, under less favourable circumstances, the smaller breeds last noticed will be most advantageous; and of these it has been repeatedly proved, by experience, that the Jersey or Alderney cows will produce by much the richest milk; and, if they be kept in equal condition with those of any other breed, will yield as great, if not greater, proportion of butter.

A perfect cow ought to have a broad, smooth forehead; black eyes; large, clean horns; a long, thin skin; a large deep body; strong, muscular thighs; a large, white udder, with four long, elastic teats, together with every other token requisite in a bull, allowing for the difference of sex. Further, such animal ought particularly to be young; for milch kine are not good for breeding after they are twelve years old, though they will often live a much longer time if their pasture be good, and they be kept from diseases.

Cows are purchased either with the view of being fattened for sale, or for the purposes of the dairy: in the former case, it

will be advisable to attend to the *kindliness* of their skins, and dispositions to fatten; but, with regard to those which are intended for breeding, care should be taken to select those which yield abundance of milk. In fact, those beasts which yield great quantities of milk, never feed quickly; and it is from repeated unsuccessful efforts to unite these two irreconcilable properties, that the different breeds of neat cattle have hitherto been brought to so little perfection. There is, it is true, a middling kind of cows, which give a tolerable quantity of milk, and also keep in pretty good condition; but, though many of this sort will become very fat when they are dried, or their milk is taken from them, yet they will not fatten so speedily or so well as those which yield a less portion of milk, and which are more kindly disposed to fatten while they are in a milking state.*

It is a general observation among farmers, that the richest milk is produced by the red cow, while the black sort is reckoned best for the purpose of breeding, as her calf is usually both stronger and more healthy than the offspring of the red species. This, however, is one of those errors which have been transmitted, through a long series of years, without being founded on fact. The red cows have, indeed, been long celebrated for the excellency of their milk; and the calves of black cows have been proverbially deemed good: but colour in this respect is a matter of no moment; the *breed* alone should claim the farmer's attention.

As, however, the dairy constitutes, in many parts of the kingdom, an object of great importance, it is a point worthy of the most deliberate discussion, whether a particular breed ought to be kept for that purpose only, or whether it be preferable to have stock calculated partly for the butcher, and partly for the dairy. "It is probable," observes Sir John Sinclair,† "that, by great attention, a breed might be reared, the males of which might be well calculated, in every respect, for the shambles; and the females of which might, when young, produce abundant quantities of good milk; yet, when they reached eight or nine years of age, might be easily fattened. This," he justly remarks,

* Culley on Live Stock, p. 89.

† In a most interesting communication of "Hints regarding Cattle," inserted in the "Farmer's Magazine," vol. iii. page 156.

" would be the most valuable breed that could be propagated in any country; and, indeed, some of the best English and Scottish breeds have almost reached that point of perfection."

The cow is supposed, by some eminent naturalists, to arrive at puberty at the end of eighteen months, though instances have occurred where these animals have produced calves before that time. It is, indeed, said by some breeders, in the northern part of this island, that young cows may be sent to the bull as early as even *one year* old, a practice which would certainly be an essential improvement where the dairy constitutes a primary object, provided their growth would not thus become stunted, which inconvenience might probably be obviated by good feeding. It is, therefore, advisable not to permit cows to take the bull earlier than two years, though the majority of breeders defer it another year; and, in conformity to the latter opinion, the late eminent Mr. Bakewell deferred sending his cows to bull till they were three years old; but his cows often missed calf, which accident Sir John Sinclair* attributes to this circumstance. In case, however, a cow produces a calf before she enters upon her third year, the animal should be removed from her; and it will be proper to milk her for the three following days, to prevent the udder from becoming sore, but afterwards to forbear milking.

The most advantageous time, in general, for a cow to take the bull is, from the commencement of May till the middle or close of July, so that she may calve in January, and thence forward till March or April. And as it is, in most places, a matter of considerable importance to have a uniform supply of milk throughout the year, we conceive it would prove a source of profit to a farmer, possessing twelve, or any large number of milch kine, so to arrange the circumstance of breeding as to have three or more cows *dry* † at one time.

In general, the cow conceives after once taking the bull;

* Hints regarding Cattle, "Farmer's Magazine," vol. iii. p. 160.

† The period of time during which cows are allowed to run dry previously to calving, is by no means settled. By some graziers they are recommended to be laid dry when they are about five or six months gone with calf; but repeated and successful experiments prove, that, in less favourable situations, six weeks or two months are sufficient for this purpose; whereas, if cows be kept in good condition, their milk may continue to be drawn till within a fortnight of calving.

but, if she should chance to fail, she should go again to bull within three weeks after. To prevent, however, this accident, it will be advisable, as soon as convenient after her return home, to throw a pail full of water on her udder behind, and to keep her that night separate from any others: for it not unfrequently happens that cows (after taking the bull) will ride each other; in consequence of which they not only misconceive, but also the quantity of milk they yield is greatly diminished.

The desire of having a frequent supply of calves has induced many to have recourse to artificial means, in order to induce cows to take the bull; a measure which cannot be sufficiently deprecated: for the most efficacious mode of obtaining this object undoubtedly consists in keeping them in good heart; in consequence of which nature will predominate over the animal's body, and cause it to show signs of procreation through the medium of the creature's constitutional feelings.

The period of gestation, or time during which the cow goes with calf, is various: with a bull calf, she usually goes about forty-one weeks, with a difference of a few days either way; a cow-calf comes in less time. Between nine and ten months, therefore, may be assigned for the period of gestation; at the end of which time she produces one calf; though instances sometimes occur when two, or even three, are brought forth. It may not, however, be useless to remark, that some cows are naturally barren, which is said to be the case when a male and female calf are produced at the same time. The male animal is perfect in all respects; but the female, which is denominated a *free martin*, is incapable of propagating her species; it does not vary very materially, in point of form or size, from other neat cattle, though its flesh is erroneously supposed to be greatly superior, with regard to flavour and fineness of the grain.

As, however, cows are very subject to abortion, when improperly treated during gestation, they ought to be observed with more than ordinary care through the whole of that period, lest they should leap ditches, &c. On no account should they be suffered to draw in the plough or other carriage, which is the practice in some countries: nor should they be milked for six weeks or two months before they bring forth their young. For about a month or six weeks before the time of calving, *it will be advisable* to turn the cow into sweet grass, if in the spring; or if it happen in the winter, she should be fed with

the best hay, where that can be conveniently supplied; in which case she will yield a larger quantity of milk than if she had been provided with that food for a longer time, because the fatter a cow is, the less milk is given; and yet, if it be too poor, there is danger lest she should fall in calving. Or she may be taken into the cow-house from the field, or straw-yard, and baited twice a day with green food, consisting of the hearts of cabbages, their decayed leaves being plucked off and given to lean cattle; turnips, potatoes, carrots, or other winter fodder, or with a mixture of bran and oat or bean meal, to which grains may sometimes be added; care being taken, in such case, to increase the quantity of meal.

The day and night after a cow has calved, she should be kept in the house, and be allowed tepid or lukewarm water only for her drink. On the day following, she may be turned out about noon, and be regularly taken in during the night, for three or four successive days. The animals thus housed should be kept till the morning cold is dispersed, and a draught of warm water ought to be given previously to their being turned into the field, otherwise a premature exposure to the damp atmosphere cannot fail of greatly weakening them.

The hints above stated are given on the supposition that the cow is well, no difficulty having happened during the time of calving; and that she has not *slipped*, or cast her calf before its full time. It should be observed, that the proper position of a calf, while in the uterus, is with its fore-feet and head foremost, its back being towards the cow's back, and its two fore-feet lying parallel to the sides of its head. Where the foetus appears in any other manner, it is termed an *unnatural position*; and the extraction of the calf, under these circumstances, requires the utmost steadiness and dexterity; as, however, no instructions can be adequate to every possible case, it will always be necessary where this event is apprehended, immediately to apply to some expert cow-doctor, lest the loss of a valuable animal should be the consequence of such injudicious treatment. During this painful operation, particular attention should be given that the pudendum or *baron* (as it is sometimes called) be not lacerated or torn: should this however take place, the part must be sewed gently up; and, if it be swollen, it ought to be washed with lukewarm milk and water.

But, where a cow slips, or casts her calf prematurely, she

must be tended with great care; and, whatever may be the cause, whether abusive treatment, violent exercise, bruises or blows, or that unnatural appetite known by the name of *longing*, every animal that has slipped her calf should be carefully separated from the rest of the herd. Cleanliness, which is an essential requisite in the general management of cattle, ought in this instance to be an object of special attention; and, as cows which are liable to drop their calves usually evince some preparatory symptoms between the cause of the abortion and the actual slipping of the fœtus, it will not be altogether useless to bleed them two or three times, as this expedient has sometimes operated as a preventive.

After, however, the calf is produced, it will be necessary to assist the natural functions of the animal, in order to carry off the secundines,* provided in the uterus for nourishing the fœtus; and which, continuing there, in consequence of abortion, would become putrescent, and thus occasion a disagreeable odour that would quickly communicate an infection among other breeding cows. For this purpose we would, at all times, recommend the following mixture to be given the cow, as soon after calving as possible: Let about three quarts of water simmer over the fire; and, when warm, strew in as much oatmeal as will be sufficient to make a strong gruel, carefully stirring the whole till it boils, that no lumps may arise; then add one quart of ale (or two of table beer) and one pound of treacle, and carefully incorporate the different ingredients by stirring. This mixture should be given lukewarm: it is peculiarly grateful to cows, which (particularly young ones) will drink it eagerly, after the first hornful, and are thus prevented from taking cold. And, as it is of importance to regulate the state of the body, this object may be effected by giving a mash of bran wetted with warm water.

Further, it will be necessary to milk the cows, especially if they be full of flesh and the udder hard, three or four times a day, for two or three days, and the calf should be suffered to suck as frequently, if in the house; or, in the field, to run with her, and suck at pleasure; care being taken to observe that the

* Or after-birth:—in the North it is termed the *cleansing*. This excrement ought to be narrowly watched, after it is passed, as cows will often eat it with great avidity.

another does not prevent it; for, if the udder or teats be sore, she will naturally be averse to suckling, and danger is incurred of losing both animals: and, in case the kernel of the udder is hard, the hardness may be removed by rubbing it three or four times in the day.

Falling down of the Calf-bed.—This usually occurs after a laborious birth, when the cow is more than usually fatigued, although some beasts are naturally disposed to such weakness. Where the falling down of the calf-bed is apprehended, the cow ought to be carefully watched; and the placenta, or cleansing, should be removed, if possible, without effusion of blood; after which the operator may gently replace the calf-bed, taking care not to withdraw his hand till the former begins to feel warm. The following draught may then be given: let bay-berries, pulverized gentian-root, and coriander seeds, of each one ounce; aniseeds and juniper berries, of each two ounces; and half a pound of treacle, be given in three pints of good strong beer; after which lead the cow gently down a hill, if there be one adjacent, as the motion will greatly contribute to replacing the calf-bed in its proper position, and render the application of stays to the womb unnecessary. Where beasts have a peculiar construction, favouring this malady, it may possibly be prevented when the period of gestation is nearly expired, by extending their stalls so as to favour their lying down; but where the calf-bed comes down, and no immediate aid can be procured, it should be deposited on and covered with a clean linen sheet; the irritation thereby produced being considerably less than that of the air, litter, &c.; and when it is replaced, those parts which have been so exposed should be bathed with new milk and brandy, rum, or spirit of wine, after which the treatment above mentioned may be pursued.

With regard to the food proper for cows, particularly as it respects their milk, and also the fattening of them for sale, the reader is referred to Sections I. and II. of Chap. III. Their diseases will form the subject of discussion in Chap. IV. Section I. and the proper time of milking them, together with the management of that nutritious fluid, will be treated *infra*, Chap. VIII. Section II.

SECTION IV.

Treatment and rearing of Calves.

ON account of the great utility of the calf, whether intended for-breed, labour, or feeding, the means of rearing and keeping this animal have called forth all the ingenuity of the most expert breeders, from the earliest moment of its existence. Hence we shall state the various treatment bestowed upon calves in different counties, and endeavour to bring into one view every useful fact connected with this subject.

After the calf is produced, the cow uniformly shows an inclination to clean its skin, by licking off, with her tongue, the slimy matter adhering to the young animal. To facilitate this object, it is a frequent practice to throw a handful of common salt over the calf, or to rub a little brandy on it, in case she should disown it, which will cause the dam speedily to perform this necessary duty; and, about an hour after the birth, half a pint of the lukewarm gruel, or mixture, mentioned in the preceding section, may be given to the calf (which prevents it from taking cold) in lieu of the *beestings*, or first milk drawn from the cow; which may be advantageously substituted for eggs in making puddings, or other culinary purposes. This mode of employing the beestings is certainly more rational than to give them to the children of cottagers, as is frequently done, whose weak organs may be supposed incapable of digesting such a strong and viscid fluid. There are two modes of feeding calves:—one is, to permit them to run about with the parent cow the whole of the first year; the other mode is, to wean them when about a fortnight old, and bring them up by hand.

The former expedient is generally allowed to be productive of the best cattle, and is adopted in those countries where fodder is abundant and cheap. There is, however, one inconvenience attending this plan, viz. that the udder and teats of the cow are liable to be bruised by the young animal butting against them with its head while sucking. To prevent the injury that might thus happen, a singular practice is pursued in the district of Galloway, in Scotland, whence the London markets are supplied with the finest meat. From the time the calves are dropped till they are able to support themselves, they are allowed to run in the manner above mentioned; but they are

prevented from sucking by means of a small piece of leather, having little, sharp, iron spikes fixed upon the outside, which is tied on the upper part of the calf's nose in such a manner as to allow it to feed upon the grass without restraint. Hence, as often as the animal attempts to suck, this instrument pricks the cow, and prevents her from letting it flow till the arrival of the milk-maid, who removes the muzzle; so that while she strips two of the teats, the calf sucks the other two; and after the process of milking is completed, the muzzle is replaced on the calf's nose in the manner above mentioned.*

Whether calves are designed to be raised for breed, labour, or feeding, care should be taken that they have a sufficient supply of good pasture; because, if the latter be scanty at first, they rarely, if ever, attain to large growth. And it may be considered as a general rule, that those calves which are dropped in October or November, are best calculated for increase; as the cow's milk is, at that time, not so well adapted to the purpose of the dairy, while the animal is less susceptible of distempers, and will thrive greatly by the nourishing pastures into which it may be turned in the ensuing spring.

Various plans have been suggested, and tried with considerable success, for rearing calves without any, or at least with a small quantity of milk. The time of weaning them varies, from one fortnight till they are seven weeks old; but the latter period is preferable, on account of the weak and tender state of the calves, if separated from the dam before they are three weeks old. In several counties of England, calves, on being taken from the cows, are, with great pains,† taught to drink

* Culley on Live Stock, p. 63.

† Of the patience and attention requisite in teaching calves to drink, a very inadequate idea only can be formed by those who have never witnessed this tedious process. When the animal has fasted two or three hours, the first and second finger of the right hand, being previously well cleaned, are presented to its mouth; of these it readily takes hold, sucking very eagerly. In the mean time, a vessel of lukewarm milk is placed, and supported by the left hand, under the calf's mouth, and, while it is sucking, the right hand is gradually sunk a little way into the milk, so that it may lap a sufficient quantity without stopping its nostrils, which will necessarily compel it to cease, from want of air. Should, however, either from accident or from too sudden precipitation of the hand into the milk, the calf let go its hold, the attempt must be repeatedly renewed till it is crowned with success.

skimmed milk, in a lukewarm state; for either extreme of heat or cold is hurtful to the beast, and not unfrequently produces fatal consequences. The time selected for this purpose is, from the latter end of January till the beginning of May, about twelve weeks after which, for three or four weeks, they are fed with lukewarm milk and water. Small wisps of fine hay are then placed within their reach, in order to induce them to eat. Towards the end of May they are turned out to grass, being taken in a few nights, when they have tepid milk and water given them; which is usually continued, though gradually in smaller proportions, during the last month, till they are able to feed themselves, when they totally disregard it. Care, however, should be taken that the grass is short and sweet, and by no means rank or sour. And Mr. E. L'Hommedieu, a spirited agriculturist of New York, (*Transactions of the Agricultural Society of New York*,) is of opinion, that calves taken from the cows were much better in a pasture without water than in a pasture of equal goodness with water. The reason he assigns (with which, however, we can by no means coincide) is, that, when indulged with water, they drink too much to supply the want of milk; whereas, when deprived of water, they are forced to eat grass, containing some moisture, and soon learn to allay their thirst, by eating before the dew is dissipated, and on that account eat more than if they could go to water. But, in the county of Suffolk, calves are usually weaned soon after Christmas; when they are fed with lukewarm skimmed milk and water, having bran or oats in it, and some very sweet hay by them, till the grass is ready; though if the farmer have carrots, these form an excellent article of food, and render the use of oats unnecessary.

Another mode of rearing calves has been suggested by his Grace the Duke of Northumberland, the design of which is to render the use of new milk unnecessary, while the expense is reduced in the proportion of two-thirds. It is effected in the following manner: let half an ounce of common treacle be well mixed with a pint of skimmed milk; then gradually add one ounce of finely powdered linseed oil-cake, stirring it till the mixture be properly incorporated, after which it is to be added to the remainder of a gallon of milk; and the whole, being made nearly of the temperature of new milk, may then be given to the animal; after a short time, the quantity of pul-

verized oil-cake may be increased. This method has been repeatedly and successfully tried by that nobleman, who, in a communication to Mr. A. Young, (by whom it has also been very advantageously adopted,) observes, that the quantities of the ingredients are so small, "that to make thirty-two gallons would cost no more, exclusive of the milk, than about *sixpence*."* (*Annals of Agriculture*, vol. 1, p. 296.) The benefit resulting from this practice must be obvious to every rational farmer and breeder; we doubt not, therefore, but that it will be resorted to in every county where milk is an object of particular importance.

An infusion of hay, called indiscriminately hay-tea, or hay-water, has been also applied to the purpose of rearing calves with the smallest quantity of milk. In order to make this infusion, such a portion of fine, sweet hay, cut once or twice, is put into a small earthen vessel, as will fill it, on being lightly settled with the hand. The vessel is then filled with boiling water, and carefully closed; at the end of two hours a brown rich and sweet infusion will be produced, not unlike alewort, or strong tea, which will remain good for two days, even during summer, and which is to be used in the following manner:

At the end of three or four days after a calf has been dropped, and the first passages have been cleansed, as already noticed, let the quantity usually allotted for a meal be mixed, consisting, for a few days, of three parts of milk, and one part of the hay-tea; afterwards the proportions of each may be equal; then composed of two-thirds of hay-water and one of milk; and, at length, one-fourth part of milk will be sufficient. This preparation (the inventor of which was, many years since, honoured with a gold medal by the Dublin Society of Arts) is usually given to the calf, in a lukewarm state, in the morning and evening; each meal consisting of about three quarts at first, but gradually increasing to four quarts by the end of the month. During the second month, beside the usual quantity given at each meal, (composed of three parts of the infusion, and one part of milk,) a small wisp or bundle of hay is to be laid before the calf, which will gradually come to eat it; but, if the weather be favourable, as in the month of May, the

* This was written upwards of thirty years ago; the expense is now probably fourfold; but the economy and benefit of the above method are in no respect diminished.

beast may be turned out to graze in a fine, sweet pasture, well sheltered from the winds and sun. This diet may be continued till towards the latter end of the third month, when, if the animal grazes heartily, each meal may be reduced to less than a quart of milk with hay-water; or skimmed milk, or fresh butter-milk, may be substituted for new milk. At the expiration of the third month, the animal will scarcely require to be fed by hand; though, if this should still be necessary, one quart of the infusion (which, during the summer need not be warmed) will be sufficient for a day.

The economical mode above detailed has been adopted in some counties of England, with the addition of linseed-cake finely pulverized and boiled in the hay-tea *only*, to the consistence of a jelly, without employing any milk in the mixture.* And, as so many excellent artificial grasses are now cultivated for the feeding and fattening of cattle, we conceive that an infusion of any one or more of them would be found more nutritious than if it were prepared from the promiscuous mixtures of grass usually occurring in common hay.

In the northern counties of England, it is a common practice to give the calves equal parts of milk and sweet whey, made luke-warm; but, as this mode often produces scouring, or looseness, we think the following method, which was a few years since communicated to the public by a spirited and experienced breeder, is greatly preferable. For the first four or five weeks he fed them regularly, but oftener than is usually done, with new and skimmed milk; at the end of which time his calves were gradually taught to drink strong water-gruel, consisting of equal parts of bean or oat-meal, mixed with one-half of butter-milk, and carefully mixed with the gruel after the latter is removed from the fire. This method of treatment he is stated to have pursued with great success for many years; his calves being strong and healthy, while every thing that may tend to retard their growth is effectually prevented.

* In the "Letters and Papers of the Bath and West of England Society," vol. v. we have a singular instance of success in this mode of rearing, by Mr. Crook. In 1787, he bought three sacks of linseed, value 2l. 5s., which lasted him three years. One quart of seed was boiled in six quarts of water, for ten minutes, to a jelly, which was given the calves three times in the course of the day, mixed with a little hay-tea. Thus he was enabled to rear in 1787, seventeen calves; in 1788, twenty-three; and, in 1789, fifteen, without any milk at all. And he states, that his calves thrive much better than those belonging to his neighbours which were reared with milk.

The following mode of rearing these animals prevails chiefly in the vicinity of Abbey-Holme, in the county of Cumberland, where the calves are remarkable for their size, fatness, and fine white colour; before, however, we detail the plan of the breeders of that place, it will be necessary to remark, that their stock is of various ages, in order that their plan may be carried on without interruption. For the first two or three weeks, the young calves are fed in the common way; and, at the end of that time, are conducted to a feeding-shed. Here two small stakes are driven into the ground for every calf, at the distance of ten inches or a foot from each other; the head of the animal is then put through the intermediate space, a strap or cord being passed round its head, on either side of which there is a ring, which surrounds the stake. By means of this contrivance the calf is prevented from licking itself, which habit would materially affect its health and growth, while it is not so confined as to be hindered from lying down or rising at pleasure. When the calf is reconciled to its new habitation, the Abbey-Holme farmers supply it with better food than it has been accustomed to receive; rightly judging that the latter part of a cow's milk is more nourishing, and of a richer quality than that which is first drawn; by this rule, they divide the milk according to the respective age of the animals, invariably giving the richest part to the oldest calves, so that, as the milk may lessen or improve in quantity or quality, they can, at all times, regulate their stock by diminishing or augmenting their numbers. Another circumstance peculiar to that district is, the varying of the temperature of the feeding-sheds according to the alteration of the different seasons. Cleanliness is also an object of rigorous attention, the place being kept constantly dried, and supplied with a proper quantity of good litter. And in case any of the animals' appetites fail, so that they do not regularly take their food, they are immediately consigned to the butcher, and their place is occupied by the next in age.

In the county of Norfolk, calves are fed with skimmed milk, in which is mixed a little wheaten flour; they have also chopped turnips in a trough, and some hay in a low rack. As soon as these animals learn to eat turnips freely, they are no longer supplied with milk, those roots, with the addition of a little hay, furnishing them both with food and drink. The period of raising calves in the above-mentioned county is from

Michaelmas to Candlemas; but the time of feeding them wholly with turnips varies, according to circumstances or accident. Where there are older calves that have been accustomed to these roots, the younger ones soon acquire the method of breaking and eating them, by picking up the fragments left by the former.

Towards the month of March, those which are first reared, are turned out among the fattening bullocks during the day; and are sheltered in the night; though, if the weather prove favourable, they are in a few days turned out altogether. In the succeeding summer they are kept in clover, or other luxuriant grasses, and, the following autumn, are sufficiently strong to stand in the straw or fold-yard. This circumstance is considered as a chief advantage to be derived from rearing calves early in the season; as those which are raised during the spring require two years nursing.

In Holland, we are informed that the calves are reared in long and narrow, but tolerably lofty, suckling houses. The pen in which the calf is kept is so narrow, that it cannot turn round, so that it can only go backwards to the end of the pen, which is also short, and forwards to the door: the house is kept in total darkness, and the pen kept perfectly clean and sweet. When the suckler comes to administer the milk, a small hole is opened, sufficiently big to admit its head to be thrust out, and which is made in the door-way; as soon as the animal perceives the light, it advances towards it, pushes out its head, which the suckler puts into the milk pail; and, being taught to drink the milk, it very soon gets fat, and much quicker than by either of our modes, where the calf is usually tied up, or is permitted to run about in an open place. The Dutch farmers hang up a piece of chalk near the door; for the animal to lick; and when the calf is about to be removed, the pen is so contrived, as to height, that, when the door of the suckling-house is open, it falls down on the tail of the cart, and the animal walks into it, and is secured. The floor of the Dutch calf-pens is of lattice work, so that it always lies dry.*

The subsequent method of raising calves, by Mr. William Budd, of Boston, in America, which obtained the prize from the Agricultural Society of Massachusetts, we give in his own language, extracted from his communication to that society.

* Malcolm's "Compendium of Modern Husbandry," vol. 1, p. 354.

"Take the calves when three days old, from the cows, and put them into a stable by themselves; feed them with gruel, composed of one-third barley, two-thirds oats, ground together very fine, sifting the mixture. Each calf is to receive a quart of gruel morning and evening, and to be made in the following manner: to one quart of the flour add twelve of water, boil the mixture half an hour, let it stand until milk-warm. In ten days, tie up a bundle of soft hay in the middle of the stable, which they will eat by degrees. A little of the flour, put into a small trough, for them occasionally to lick, is of service. Feed them thus till they are two months old, increasing the quantity. Three bushels of the above mixture will raise six calves."

Mr. Clift, of the New York Agricultural Society, takes the calf from the cow at two or three days old; he then milks the cow, and while the milk is warm, teaches the animal to drink by holding his head down into the pail; if the calf will not drink, he puts his hand into the milk, and a finger into the mouth, till the beast learns to drink without the finger. After he has been fed with new milk for a fortnight, the cream is taken off the milk, with which an equal or larger portion of thin flax-seed jelly is mixed, and the whole is given milk-warm. Thus, as the spring is the most favourable season for making butter, he is enabled, during the six or seven weeks the animals are kept previously to weaning, to make as much butter as they are worth; a practice which merits the attention of our English farmers, to whom it will afford a very essential saving, particularly in those counties where butter forms a chief article of manufacture.

In the rearing of calves, much, however, depends on the regularity of feeding them; the common practice is, to supply them with food twice in the day, in the morning and at evening, when they generally receive as large a quantity as their craving appetites can take. Hence the digestive organs are necessarily impaired, and numerous animals either become tainted with disease, or perish from the inattention of their keepers; whereas, by feeding them thrice in the day, at equidistant intervals, and allowing sufficient room for exercise, they will not only be preserved in health, but they will also greatly improve in condition.

Veal being a favourite article of diet, the fattening of calves

is an object of no small importance, particularly in the vicinity of the metropolis, where the lands are more profitably occupied in other branches of rural economy. Hence various sorts of food are provided, and numerous modes of treatment have been recommended. Their provender is now, for the most part, turnips, potatoes, grains, pollard, and sweet hay; but the most effectual, and consequently the best way, is to keep them in pretty dark places, in coops, lest they should fatigue themselves by sporting too much in the light, which would be injurious to them. Further, as cleanliness is an indispensable object in fattening cattle, it should, in the present case, be particularly attended to; for this purpose, the coops ought to be elevated at such a height from the ground that their urine may pass freely off; fresh litter should be supplied every day, in order that they may lie dry and clean; and a large chalk-stone should be suspended over the coop, so that the calves can easily lick it. It is also a common practice to bleed them when they are four or five weeks old, and again a little time before they are killed, by which contrivance the whiteness of their flesh is greatly increased: the quantity of blood taken is almost two quarts, or more, according to the age and strength of the calf. The operation of bleeding is, therefore, frequently repeated by some persons, though it does not appear to be altogether necessary; as the most experienced breeders are of opinion, that it is sufficient to bleed them twice, drawing from them such a quantity at each time as their age and size will allow without hazard of destroying the animal.

With regard to those calves which are intended for the draught, it will be advisable to accustom them, while young, to be handled and stroked, and tied up to the manger; as they may, when they come to be broke, be handled with less apprehension of danger.

The best time for castrating male, or spaying female calves, undoubtedly is when they are fifteen or twenty days old, as at that time there is least danger, provided they be in full health; though, in conformity to the opinion of some eminent natural historians, this operation is in some places, particularly in Scotland, deferred till the animals are three years old. Formerly this object was effected by tying a strong cord round the small part of the testicles, near the body, till these became completely dead, when they were either suffered to remain till they dropped

spontaneously off, or were cut off, and the animal was perfectly castrated. Modern ingenuity, however, has devised a better means of eradicating the testicles, by excision; but, as this cannot be effected without resorting to an experienced farrier, or cow-doctor, we decline to give any directions respecting an operation which, if unskilfully performed, must prove greatly injurious to the animal. Let it, therefore suffice to state, that, after the calves are castrated or spayed, as the difference of sex may require, great care ought to be taken that the wounded part be not exposed to the air, which might otherwise occasion loss of blood or other accidents. For the first two or three days, the animals should be kept quiet and tolerably warm, and be dieted according to their weakness; but they ought not to be allowed too much drink till they are perfectly recovered, after which time they may be treated in the usual manner. With regard to the diseases of calves, *vide infra*, Chapter IV. Section II.

SECTION V.

Of the Ox. The best Time and Methods of breaking him for Labour. Comparative View of the respective Utility of Oxen and Horses.

THE OX is an animal of no small utility for various purposes of husbandry, particularly for the draught, though its real value has only become generally known within a few years.

The most valuable breeds of these animals for working, in this island, are those of Devonshire, Sussex, and Herefordshire, together with the oxen reared in the counties of Somerset, and Pembroke, and especially in Glamorganshire, whose breed is said to be even superior to that of Devonshire, both for working, and cheap and quick fattening. As the distinctive characters of these breeds have already been specified in our Introduction, we now proceed to state the principal objects requisite to be attended to in purchasing these animals; (for the husbandman who intends to stock his land, must purchase before he can breed his own cattle;) after which the most advantageous methods of working them, together with a comparative view of the merits or demerits of oxen and of horses, will present themselves for discussion.

A good ox for the plough should be neither too fat nor too lean; as, in the former case, he will be too lazy; and in the latter, he will be too weak and unfit for labour. His body ought to be full, joints short, legs strong, eyes full, his coat smooth and fine, (which latter circumstance is a certain indication of good health,) and every part symmetrical, or well put together, so that his strength may be easily seen. Another requisite is, that he answer to the goad, and be obedient to the voice; but this animal can only be brought willingly to bear the yoke, or be easily governed by lively but gradual and gentle treatment. Those calves, therefore, which are designed for the yoke, should not be broke earlier than two and a half, or three years, lest they be overstrained; nor should that operation be deferred longer than three and a half, or four years, as they will become froward, and too stubborn to submit to the yoke.

The strength of this animal, when properly trained and managed, is very great, and he has patience to endure fatigue; but, being naturally slow, he must not be exerted beyond his usual pace. The only method by which success can be attained is, by patience, mildness, and even by caresses; for compulsion and ill-treatment will irritate and disgust him. Hence, great assistance will be derived from gently stroking the animal along the back, by patting him, and encouraging him with the voice, and occasionally feeding him with such aliments as are most grateful to his palate. It will also be proper to tie his horns frequently, and after a few days to put a yoke upon his neck, when he should be fastened to a plough with a tame old ox, of equal size; next, the oxen should be employed in some light work, which they may be suffered to perform easily and slowly: thus they will draw equally, and the young steer will be gradually inured to work. After working in this manner, he should be yoked with an ox of greater spirit and agility, in order that the steer may learn to quicken his pace; and, by thus frequently changing his companions, as occasion may allow, he will, in the course of the first month or six weeks of his labour, be capable of drawing with the briskest of the stock.

After a steer is thus properly broken, it will be advisable, for the future, to match such as are intended to draw in the same team, or yoke, attention being paid to their size, strength, and spirit or temper; otherwise, by being unequally matched, they will not only spoil their work, and be greatly disqualified

for draught, but also, by being urged beyond their respective natures, through severe usage, they will inevitably receive material injury.

Another circumstance of essential importance in breaking-in young oxen is, that, when first put to work, whether at the plough or in teams for draught, they be not fatigued, or overheated; till they are thoroughly trained, therefore, it will be necessary to employ them in labour only at short intervals; to indulge them with rest during the noon-day heats of summer, and to feed them with good hay, which, in this case, is preferable to grass. In fact, while oxen are worked, they must be kept in good condition and spirits, by moderate, but wholesome sustenance. Further, on their return home from labour, it will greatly contribute to preserve their health, if their feet be well washed previously to leading them into their stalls; otherwise diseases might be generated by the filth adhering to them; while their hoofs, becoming soft and tender, would necessarily disable them from working on hard or stony soils. The extremes of heat and cold ought also to be carefully guarded against, as disorders not unfrequently arise from excess of either temperature, and they are peculiarly exposed to fevers and the flux, if chased up and down, especially in hot weather.

The following mode of training and working oxen, which has been successfully adopted in North Britain, we give in the words of the farmer by whom it is practised, from the 3d vol. of "The Farmer's Magazine," p. 450; a work whose extensive circulation is the best proof of its merit.

"Out of my stock of cattle," says he, "I select, when two years old, (that is, after harvest, when they are rising three,) four of my stoutest, best-shaped *stots* from the field. These, to accustom with harness, I bind up in my oxen byre every night, for a week or two; and they are then taken out in pairs, and put into the plough with a pair of older-trained oxen yoked before them. This keeps them steady, and prevents their running off. After being yoked in this manner two or three times, I turn them again amongst the cattle in the straw-yard, where they remain until spring. They are then three years old. I yoke them all four, after training them as above stated, in a plough by themselves, which requires a little boy to drive; and in that way they are used until four years old, when they are worked in pairs as horses, by one man only, and do the same

work at ploughing; for at carting, &c. I never use them, having as many horses as do that part of my work. When used in pairs, one man works two yokings, and the cattle only one each. If, however, I had occasion for two cattle-ploughs, each pair might work very well two yokings, the same as horses."

The same intelligent correspondent also remarks, in addition to the above: "if, when three years old, eight *stots* were worked, four and four *alternately*, it would be a great relief; and I have uniformly found that cattle *moderately worked* thrive better than those that are idle, or unemployed."

The general character of the ox, is, patience and tractability, though young steers sometimes prove refractory and vicious; which, however, is in most instances the result of defective management, or of bad treatment when first *broken* for the yoke. When, therefore, an ox is unruly or stubborn, it will be advisable to keep him till he is hungry; and, when he has fasted long enough, he must be made to feed out of the hand. On his returning to labour, he should be tied with a rope; and, if he at any time become refractory, gentle measures should be adopted, as above described, in order to bring him to work readily and quietly.

In working oxen to advantage, much depends on the mode of harnessing them, and upon what has been termed the *principle of draught*. This principle, as Lord Somerville has judiciously remarked, (in his interesting work, "The System followed, during the two last Years, by the Board of Agriculture, &c." 8vo. second edition, 1800,) depends on the joint power of the neck and base of the horn. In Portugal, these animals are harnessed in the following manner: a long leather strap is wrapped round the yoke, whence it passes round the lower part of the horns, and is again fastened to the yoke. By this contrivance, the heads of the oxen become more steady, while performing their work, and these useful animals are rendered more tractable.

In France, oxen are worked by *the head*, and are yoked in a manner which is better expressed by the aid of figures than by description. Plate II. figure 1, therefore, represents a view of the hinder part of the head and neck of these animals in the yoke, as they appear to a spectator; and figure 2 exhibits a front view of the upper part of their heads, in order to convey a more accurate idea of the mode in which the French oxen are

fastened to the bow; this method being, in the opinion of the noble agriculturist above mentioned, the best preparatory step towards introducing the Portuguese manner.*

Connected with the subject of draught is another, which has only received, of late years, that attention which it required, viz. the *shoeing of oxen*; a necessary operation, which, when carefully executed, will not only conduce to the animal's comfort and health, but also to the farmer's profit; as he will thus be enabled to draw both with greater speed and with superior effect. According to the common practice, the animal is first *cast*, or thrown, and his legs bound together in the usual manner; he is then forced nearly upon his back, and his feet are hoisted up to a convenient height by means of a forked pole, the forked end taking the bandage that binds the feet, while the opposite end is firmly fixed in the sward upon which they are thrown; the farmer then proceeds to affix the shoes in a manner similar to that practised on horses. By this simple contrivance, the operation acquires great firmness, steadiness, and conveniency; but it is attended with one great disadvantage, as oxen are apt to become unruly on seeing their companions thus roughly treated; and many valuable cattle are often rendered completely useless. To obviate such accidents, an ingenious machine has been invented in order to secure the animal, by means of short posts. On these the fore or hind legs are fastened, as circumstances may require, and thus the shoes are applied without any possibility of injuring the beast. It has, indeed, been suggested,† (and we think the plan might be easily carried into effect,) that if calves, intended to be reared for work, were accustomed, while young, to have their feet taken up, and their hoofs beaten with a hammer; and that, if this practice were repeated during the winter, while the steers are in the yards, they might afterwards be shod in the same manner, and with equal facility as horses.

Few subjects have, of late years, more exercised the ingenuity of theorists, and the attention of farmers, than the question concerning the superiority of oxen to horses. The use of

* We understand that the Earl of Shannon introduced this method of yoking oxen into Ireland, a few years since, with the happiest success; as *two* oxen thus harnessed, were enabled, with great ease, to draw the enormous weight of *three* tons.

† Marshall's "Rural Economy of the West of England," vol. ii. p. 285.

these animals, even under many impediments, has been persevered in for many ages, and will continue in every country where a breed of cattle exists which are active of themselves, and of a form and size well calculated for labour. And, in the ancient law work, denominated *Fleta*, (which is supposed to have been written about the time of Henry I.) we have indubitable evidence, not only that oxen were then commonly used for the purposes of husbandry, but also of their superiority over horses. The author of that work states, first, that two oxen and two horses will plough as much in one day as four horses: secondly, that in heavy land, oxen made a stronger draught;* thirdly, that a horse requires the sixth part of a bushel of oats *per diem*, whereas, for a whole week, three one-half measures of oats (ten of which make a bushel) are sufficient for an ox: lastly, that an old horse is of no value, except for his skin; while an ox, after being past labour, will yield a good price when fattened.†

Equally strenuous in favour of these animals is the author of the "Boke of Husbandry," Judge Fitzherbert, who lived in the time of Henry VIII. "It is to be known," says he, "whether is better, a plough of horses, or a plough of oxen, and therein meseemeth ought to be made a distinction. For in somme places a horse-plough is better; that is to say, in every place: whereas the husbandman hath several pastures to put his oxen in, whan they come fro their warke; there the ox-plough is better. For an ox may not endure his warke, to labour all daye, and than to be put to the commons, or before the herdman, and to be sette in a foulde al nyghte without meate. But and he be put in a good pasture all nyghte, he will labour much of all the daye dayely.

"And oxen wyl plowe in tough clay and upon hylly ground, whereas horses wyl stand styll. And whereas is now suerall pastures, there the horse-plowe is better, for the horses may be teddered, or tyed, upon leys, balkes, or hades, whereas oxen may not be kept; and it is not used to tedder them, but in few places. And horses wyl goo faster than oxen on even ground or light ground, and be quicker for carriage; but they be farre more costly to kepe in winter, for they must have bothe hey and corne to eate, and strawe for litter; they must be well shodde

* *Fleta*, lib. ii. c. 73. s. 2.

† *Ibid.* s. 3.

on all foure fete; and the gere that they shall drawe with is more costly than for the oxen, and shorter whyle it will last. And oxen wyll eat but straw and a lyttel hey, the whiche is not half the coste, that the horses must have, and they have no shoes as the horses have." [But the practice is now changed as to this point, and the shoeing of oxen, though essentially necessary, is infinitely cheaper than that required for horses.] "And if any sorance come to the horse, or waxe old, broysed, or blynde, than he is lyttle worthe; and if any sorance come to an oxe, or he wax olde, broysed, or blynde, he will sell for ii s. and than he is manne's meate, and as good or better than ever he was. And the horse, when he dyeth, is but caryen. And therefore meseemeth, all thinges considered, the ploughe of oxen is much more profitable than the ploughe of horses."*

For the length of this extract from the learned judge, (who was himself a practical husbandman, and consequently has here given the result of many years experience,) its excellence, we trust, will be a sufficient apology; as when taken in connexion with the account of Fleta, it will present a striking record, or document, of the superior utility of oxen over horses. In order, however, that this important subject may be placed in as clear a point of view as possible, we shall proceed to contrast the respective services of the two animals, supporting our remarks on *modern data*; though, probably, some of the preceding strictures may seem to render them unnecessary. And, when it is considered, that oxen, fit for grazing, are now of rare occurrence, it becomes daily a question of greater moment, particularly as it respects the supply of our navy.

I. *With regard to their original price, or cost.*

The prime cost of an ox, upon an average, is at least one-half less than the price of a horse; hence it is obvious, that an ox of the value of £. 7 or £. 8 will perform the same quantity of work as a horse worth £. 14 or £. 16. This is a circumstance of no small importance to a young farmer, to whom labouring cattle are the most expensive part of his stock, as he can thus be enabled to branch out his capital into various useful channels.

* "Boke of Husbandry," p. 78. Edit. 1767.

II. *With respect to labour.*

By well-known means the nature of the bull is tamed; and, when properly *broken*, the ox becomes as tractable, and may be trained to the plough or to draught as easily as horses. Of this we have numerous instances. Messrs. Culleys, of the county of Northumberland, employ 150 oxen in the draught, which practice they have followed, with great success, for more than thirty years. The animals are used singly in carts, and two in a plough, with cords, without a driver; and thus they perform their allotted work of ploughing, carrying corn, dung, &c. in all respects as well as two horses, though not with equal celerity. The late Lord Kaimes states,* that Colonel Pole, lately deceased, of Radburne, in Derbyshire, ploughed as much ground with *three* oxen, as his neighbours did with four or five horses; feeding them in summer with grass, and in winter with straw, when moderately worked, or, when much worked, with hay or turnips. The late Right Honourable Edmund Burke, at his ground near Beaconsfield, in the county of Bucks, ploughed one acre *per diem* with *four* oxen, while his neighbours performed the same work with an *equal number* of horses.

In ploughing and rolling, oxen are extremely useful. Horses are better in harrows, from their quick step, by which the pulverization of the soil is accelerated: in harvest likewise, when expedition is necessary, horses are preferable. In breaking up old turf-land, however, oxen are better in the plough, their motion being more steady than that of horses; the flag is less broken in turning over, which is a great advantage. For short carriages, as in carting dung, turnips, &c. the advantage of using oxen must be very great; and they may occasionally be used in the plough, when the horses are sent for lime, or to market.†

For the two following facts, which evince the superiority of oxen, even under circumstances unfavourable to these animals,

* "The Gentleman Farmer," p. 30, 5th Edit. 1802; an interesting and practical work on husbandry, to which we are indebted for some of the following hints and facts.

† Sir John Sinclair's Account of the Systems of Husbandry in Scotland, vol. i. p. 123, which contains numerous important facts relative to the working of oxen.

we are indebted to that enlightened agriculturist, Lord Somerville,* of whom we have already had occasion to make honourable mention.

At the last meeting, in 1803, of the Dublin Society, his lordship was informed, by a spectator of undoubted veracity, that several ploughs were entered for the prizes given; and, to the surprise of every one, the oxen beat the horses in speed; they were worked in pairs only, without drivers. These animals, he states, were not selected from the breeds most esteemed for labour, but from the oxen of that country.

Of the succeeding instance, Lord S. was himself an eye-witness.—In May, 1803, a meeting was held at Burnham Wyck, in the county of Essex, to award three prizes which were given for the best ploughing. Upwards of twenty ploughs started, three of which were each worked by three pair of oxen, without drivers. These animals were bred on the estate, and of a sort which are deemed by no means well adapted to labour; the horse-ploughs were *picked teams*. The difference of time in finishing the work allotted was, to the best of his lordship's remembrance, about twelve or fourteen minutes between the average of the horse and ox teams; so that, supposing them to be an hour and a half longer in their day's work, the difference in the time of rest will be, if any thing, in favour of the oxen; because animals which perspire by the tongue, do not require the dressing and attention demanded by those whose perspiration escapes by the skin.

The following is his lordship's method of working oxen: the animals are *broken in* at three years old, their first half-year's work being easy. At six years old they are sold to graziers, and in eight months they come to Smithfield good beef. In the intervening period his work is done at the rate of about eighty acres of tillage to four oxen; and his twelve oxen, exclusive of the three-years old steers, will work thirty acres of land *per week*, when not employed in carrying lime or manure, which is ten acres *per week* for each four oxen, or five acres for each pair, that is, two acres *per diem* for four days in the week, for each team of four, allowing them two resting days. Thus their daily labour is completed in seven hours and a half, which gives them sixteen hours for rest. Lord S. remarks, that if they were

* "Farmer's Magazine," vol. iv. p. 342.

allowed corn, they would probably do more work; and, if they did less, he would not employ them at all. He allows one horse to every 100 acres of land, for extra work, and no large number.

Lastly. Before we conclude the present contrast, as it respects *labour*, we would observe, that oxen are preferable to horses for *steady* draught, as they uniformly pull to their strength, without variation; whereas the last-mentioned animals are apt to stop on encountering the slightest resistance. And though it is objected, that oxen are unfit for draught in mountainous situations, yet, let it be recollected, that under such circumstances no *draught can well be used*; and that the descending of steep hills is, in all respects, as dangerous to horses as to oxen. In addition to the facts already stated, it may be added, that notwithstanding oxen have less air and spirit than a horse, their motion is not materially slower; and as the labours of husbandry are regular and progressive, the step of these animals will be found little inferior to that of the horse. They are, indeed, reputed to be less expeditious for galloping or trotting; but repeated instances have occurred, where Sussex oxen have *beaten* horses at plough in the deepest clay; and the Herefordshire breed is admitted to be superior to any other in long journeys, for conveying chalk, or other heavy substances, over a hilly and flinty country road. In the north of England, we understand that it is not an unfrequent occurrence, to see a light ox saddled, and briskly trotting along the road, obedient to his rider's voice: the Devonshire cattle also walk with uncommon speed; and, if four or five horses can till 100 acres of land, the same work might doubtless be equally well performed by a similar number of the Devonshire or Herefordshire breeds, provided they were trained and fed with a special view to *speed*, with the same care as horses.

III. *Comparative expense of keep and general savings.*

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| <p>1. Oxen are easily supported, during the severity of winter, on straw, turnips, and other vegetables of which a particular detail will be given, <i>infra</i>, Chapter III. Section II.</p> | <p>1. Horses require to be fed with hay, oats, or beans, articles which can only be purchased at a heavy expense. The digestive powers of a horse are weak, so that, upon</p> |
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- Besides, as ruminating animals possess stronger digestive organs, every thing capable of affording nourishment is extracted from their food.
2. Every day that oxen are employed, they earn more than their keep; while, if properly fed, they will require no other care.
 3. The *gear* necessary for a pair of oxen may be procured at a very moderate price.
 4. At the end of five, six, or seven years, during which they will have more than compensated the cost of keeping them, they are in prime order for fattening; and, when fit for sale, produce to their owner a handsome sum, varying indeed according to the state of the markets, but ultimately bringing him a considerable clear profit. The same event will follow, if, through accident, the beast is lamed, or rendered unfit for work.
 2. A horse not only requires more stable attendance than oxen, but also often exhausts the property of little farmers, who exert themselves in order to keep a *fine team*.
 3. The harness of a team is, in general, an expensive article, especially when the vanity of the owner induces him to have it decorated with paltry brazen ornaments.
 4. Horses become less valuable every year they are kept. They are liable to spasms, farcy, glanders, foundering, cankers, and a host of diseases too numerous to be here specified, from all which oxen are exempted, (these animals being subject to few diseases, except a scouring, or looseness, that reduces their value); while horses are, by sudden illness, or lameness, speedily diminished in value, from *forty* to *four* guineas, and at length become food for dogs, their hide only being in any degree serviceable to mankind.

Another advantage arising from the keeping of oxen preferably to horses will be, the introduction of a more lenient conduct towards those useful animals; and, as has been judiciously

observed, in proportion as ox teams are used, they certainly diminish animal suffering; for no man will work his ox team so hard, or feed it so inadequately, as horse teams are sometimes worked and supported, merely with the view of gratifying a false vanity.

The following comparative statement of the expense of keeping, management, &c. of horses and oxen, will probably elucidate the facts above attempted to be brought together.*

HORSE.	OX.
Prime cost of a horse at four years old . . . £.30 0 0	Prime cost of an ox at three years old £.20 0 0
Keep, shoeing, attendance, &c. &c. for ten years, at £.30 per Ann. 300 0 0	Keep, &c. for ten years, at £.10 per Ann. 100 0 0
	£.120 0 0
£.330 0 0	Deduct the value of fat 40 0 0
Deduct the value of skin and car- rion 1 1 0	Total cost of an ox <u>£.80 0 0</u>
Total cost of horse £.328 19 0	
Ditto of ox 80 0 0	
Difference in favour of the ox . . . <u>£.248 19 0</u>	

* Communicated to the "Farmer's Magazine," vol. v. p. 181, by an intelligent agriculturist of the county of York. Numerous additional facts might be stated, equally convincing in their results; but as the introduction of these would only tend to enlarge our work, they are necessarily omitted.

On this statement we have only to observe, that, as it is a fact that *one draught horse* will, exclusive of hay, consume more corn than a family of ten or twelve persons, and as it is morally impossible that small farms, worked by *heavy horses*, can find constant employment for them, the community must, under such circumstances, not only sustain an annual loss to the amount of several millions, but also lose the benefit of a supply of *good beef* for home consumption, and especially for the use of that meritorious class of subjects, the BRITISH SAILORS.

In the preceding estimate of the merits and demerits of horses and oxen, though it has been endeavoured to show that the latter animals are infinitely superior, and consequently preferable, to the former, yet we would be understood to recommend the use of oxen only where they *suit*, or are consistent with local and other circumstances; for, doubtless, where counties, or districts, do not possess a breed of cattle well calculated for work, as oxen; or on small farms, from which fairs must be attended at a considerable distance, to purchase a few, consequently at a great expense per head, and possibly without a supply of land for fattening any, the loss in such case is almost certain. It will, therefore, be proper for the farmer, who is thus situated, to avail himself of the bulls of the country, which may be advantageously substituted for, and probably much cheaper than oxen, and which may be broken-in and worked with equal facility. Thus, on all light sandy soils, as Mr. Billingsley justly remarks, (Bath Papers, vol. x. p. 66,) such as Norfolk, Suffolk, &c. single ploughs of different constructions, drawn by two horses, without a driver, may, in cheapness of execution, nearly approach the double furrow, drawn by four oxen. But on all level soils, unincumbered with stones, and where good pasture may be found for *summer*, and good hay for *winter-keeping*, oxen with the double plough may be considered as justly entitled to a preference.

As, however, there is some business on a farm, in the performance of which horses are greatly superior to oxen or bulls, the husbandman will find it conducive to his interest to keep a few draught horses for that purpose. But, notwithstanding all the acknowledged advantages resulting from the employment of oxen on farms, there are two objections sometimes urged against this system; which we shall now briefly notice. The first is, that the working of oxen injures the meat, rendering it

hard about the neck; but this is altogether unfounded. There is no doubt, as Mr. Malcolm pertinently remarks, but that, if an animal were slaughtered the moment he came from work, after three, four, or more years continual hard labour, the flesh about the shoulders of such ox will be callous. "But, put that ox up to fatten, and a revolution presently takes place; he thrives more kindly than one which has not been worked; fresh matter is generated and diffused in the nature of fat; it does not attach itself to one part of the body and leave all the rest without any; it does not fix itself to the ribs, and leave the shoulders bare. The juices flow through the veins there, as well as every where else; and, by consequence, whatever tends to fatten other parts, will do so by the shoulders; and I think it is hardly probable that, where there is any quantity of fat, the flesh beneath it can be hard; because it is the peculiar property of fat to make things soft, especially flesh."*

A second objection, which is more prevalent, is, that oxen are apt to be mischievous in hot weather, when attacked by flies and other insects; but, in the opinion of the intelligent agriculturist last mentioned, if these animals were worked early and late, and lay by during the heat of the day, the danger would, in a great measure, be removed. In addition to this remark, we would observe, that the objection now in discussion would be obviated by employing only *hornless* oxen. For the purposes of work, Mr. Marshall considers it as obviously necessary to obtain a breed without horns; which he thinks may be effected, since there are now many polled or hornless breeds of neat cattle in this country, from which (as in the case of sheep) a hornless race might, by persevering attention and industry, be raised. Nor, in his opinion, would any disadvantage result from this practice; because, to cattle in a domesticated state, horns are altogether useless, and also because *horn*, as an article of commerce, is not, at present, held in that request which it formerly was. In the prosecution of this design, the first step Mr. M. directs is, to select females; and, having observed their defects and imperfections, to endeavour to correct and improve them by a well-chosen male.

* Malcolm's "Compendium of Modern Husbandry," vol. I. p. 359, 360.

SECTION IV.

Of the Sheep.

AMONG the various animals given by the benevolent hand of Providence for the benefit of mankind, there is none, perhaps, of greater utility than the sheep; which not only supplies us with food and clothing, but also affords constant employment to numerous indigent families, in the various branches of the woollen manufacture; and thus, by inducing habits of industry, contributes, in no small proportion, to the *productive labour*, and commercial prosperity and opulence of this highly-favoured island.

In a wild, or natural state, the sheep is a vigorous animal, lively, and capable of supporting fatigue; when domesticated, indeed, it loses these properties, but amply compensates for the absence of them by the superior advantages arising from the rearing of this sort of cattle. In fact, sheep constitute a material part of a farmer's live stock and profits; and as particular attention has, of late years, been bestowed on the improvement of the respective breeds, we shall first refer the reader to the introductory view of the different breeds of cattle prefixed to this work; which will, we trust, convey an adequate idea of the different varieties, together with their specific characters, and the peculiar advantages they respectively possess. The general management of these animals will afterwards form a subject of discussion.

With respect to the selection of sheep, as an article of *live stock*, the same principle of symmetry of form, and other requisites to the formation of a good breed of black cattle, which have already been specified,* are equally applicable. The breeder, or grazier, should also carefully examine the nature of his land; and having attentively weighed its relative degrees of fertility, and his various sources for supplying food, he may

* Vide *Supra*, Chapter I. Section I. pp. 28—32.

then proceed to purchase that breed, which, after mature consideration, he has reason to believe is best calculated for him. In this point, the introductory view of breeds and varieties, already referred to, will probably afford some guide; but there are some additional hints, to which we would call his attention. In the first place, therefore, he should take care not to suffer himself to be led into needless expenses, in purchasing fashionable breeds, by which his affairs might become involved, and his exertions in other objects be rendered nugatory. Secondly, the difference of the land, whence the sheep are to be purchased, ought to be attentively weighed: for with sheep, as with cattle stock, if any breed be brought from a rich to an inferior soil, it must necessarily decrease in value and condition. Not only, therefore, must sheep be *suited* to the pasture, but they should also be purchased from poorer land than that of the intended proprietor, for on attention to this last point depends their immediate thriving.

Having thus noticed the general objects in selecting sheep, we now proceed to state some *particular* points that will demand the breeder's attention; and, as in all cattle the *male* has the greatest influence, we shall specify those requisites which are essential to a good *ram*.

"His head should be fine and small; his nostrils wide and expanded; his eyes prominent, and rather bold and daring; ears thin; his collar full from his breast and shoulders, but tapering gradually all the way to where the neck and head join, which should be very fine and graceful, being perfectly free from any coarse leather hanging down; the shoulders broad and full, which must at the same time join so easy to the collar forward, and chine backward, as to leave not the least hollow in either place; the mutton upon his arm, or fore-thigh, must come quite to the knee; his legs upright, with a clean, fine bone, being equally clear from superfluous skin, and coarse hairy wool, from the knee and hough downwards; the breast broad and well forward, which will keep his fore-legs at a proper wideness; his girth, or chest, full and deep, and, instead of a hollow behind the shoulders, that part, by some called the fore-flank, should be quite full; the back and loins broad, flat, and straight, from which the ribs must rise with a fine circular arch; his belly straight; the quarters long and full, with the mutton quite down to the hough, which should neither stand in nor

out; his *twist* (i. e. the junction of the inside of the thighs) deep, wide, and full, which with the broad breast, will keep his four legs open and upright; the whole body covered with a thin pelt, and that with fine, bright, soft wool."*

Such is the description of the animal recommended by Mr. Culley, who observes, that the nearer any breed of sheep comes up to it, the nearer they approach towards excellence of form; and there is little doubt, but if the same attention and pains were taken to improve any particular breed, which have been bestowed on the *Dishley breed*, (so denominated from the residence of the late Mr. Bakewell, its first selector,) the same beneficial consequences would be obtained.†

In addition to the symmetry and other requisites above specified, it may be remarked, that as the fine quality of the wool depends greatly upon the breeder's judgment, the young grazier will find it beneficial to his interest to consult some experienced wool-stapler, or clothier, who, from his occupation, being accustomed to examine wool, is consequently enabled to determine, not only with accuracy, but also with a view to the breeder's real profit. Further, the pelt, or coat, should be attentively investigated, lest it be *stitchy haired*, in which case the wool will be so materially damaged, in the course of two years, that the injury cannot be recovered for twelve or fourteen years, unless the whole flock be changed.

With respect to the *time*, or proper age, for purchasing sheep intended for breeding, there is a difference of opinion: but the most experienced breeders recommend these animals to be procured, a short time previously to shearing, from the farmer, grazier, or owner's house; because they will then be seen in their natural state, and the *real* depth of the staple may also be easily ascertained without the possibility of any fraud or imposition being practised on the buyer by the vender.

Ewes generally breed at the age of fifteen or eighteen months, though many experienced breeders never admit the ram till they are two years old. Much, however, depends, in this respect, on the goodness of the food, as well as on the forward or backward state of the breed; and, from the great profit

* Culley on Live Stock, p. 103, 104.

† For the peculiar advantage of this excellent breed, the reader is referred to the introductory view already noticed.

which these useful animals afford to their keepers; they require no inconsiderable attention to be bestowed upon them.

The *choice* of ewes, therefore, ought to be made with care and discrimination, not only as to the characteristic marks, which ought to be the same as those of the ram, but also with regard to the *breed*; for, with sheep, as with other cattle stock, no certain degree of excellence can be attained, unless the *female possesses an equal degree of blood with the male*. In particular, a purchaser should see that the animals be *sound*; and, in order to ascertain this point, it will be advisable to examine whether the *teeth* are white, the *gums* red, the *breath* not fetid, the *eyes* lively, the *wool* firm, and the *feet* cool; qualities these which afford a certain criterion of health or disease.

Of equal importance is the proper adaptation of *rams* to the *ewes*; and, in attending to which point, the conduct of the late Duke of Bedford (whose memory every real friend to his country must revere, deserves to be imitated by every attentive breeder. Previously to drawing off any ewes for particular rams, it was his constant practice to select every ram, together with the lambs begotten by it in the preceding year, from the rest of the flock, and confine them in separate pens, in order that he might examine them and their issue, and thus be enabled to make a proper determination.

Ewes bring forth one, two, and sometimes three lambs,* after a gestation of five months, or twenty weeks; hence the sheep-farmer, or breeder, may, in general, by considering whether he has sufficient grass to support the ewes and their progeny in the spring, ascertain the most advantageous period for lambing; or, in the event of a failure of pasturage, whether he has a stock of turnips adequate to their maintenance till there is a sufficient herbage to supply them with food.

* The most prolific sort is the *Teeswater* variety of the Lincolnshire breed, of which Mr. Culley has given the following instances. An ewe belonging to Mr. Eddison, when two years old,

In 1772,	brought him four lambs,
In 1773,	 five lambs,
In 1774,	 two lambs,
In 1775,	 five lambs,
In 1776,	 two lambs,
In 1777,	 two lambs;

and of these the first nine lambs were weaned in eleven months.

The usual time of yearing is towards the end of March, or early in April; consequently the rams are, according to the general practice, admitted in the commencement of October. But in the county of Dorset, where the ewes are, from a peculiarity in their constitution, capable of bringing lambs twice in the year; and also in the southern and south-western districts, where large quantities of house-lamb are raised for the table, it is more profitable to deviate from this plan, and so to admit the ram, that the lambs shall be dropped from four to six weeks, or more, earlier.

The strength and beauty of sheep stock also greatly depend on the number of rams allowed to serve the females. While the former are young, fifty or sixty should be the utmost extent; and, as they advance in years, the number may be gradually increased; without these precautions, the lambs would not only be deficient in number, but also in point of strength.

Various expedients have been resorted to, in order to make the ewes *blossom*, (i. e. to want the ram); among others, is the practice of worrying them with small dogs, kept for that purpose, in consequence of which they become *warmed*, so that they seldom refuse the ram. But it is much better, and certainly a more rational plan, to keep the rams and ewes in different pastures, till the time when they are intended to be brought to the rut; and for about five or six weeks before, let them have somewhat better pasture than they are usually accustomed to, by which expedient they will be disposed to take the ram the sooner. In fact, it is with sheep as with other cattle, the female must be in a certain state desirous of the embraces of the male before the latter will attempt to serve her; and this object can only be attained by increasing the richness of their food a short time before they are required to couple; for, in proportion to the excellence or poverty of their food, the bodily vigour of these animals must evidently increase or diminish.

During the period of gestation, ewes require great attention, lest any accident should befall them, and occasion them to *slip* their lambs; and, if the latter should take place, it will be proper to separate them instantly from the rest of the flock. It will, therefore, be necessary to keep them in the same manner as cows, while going with calf, viz. upon a moderate, or tolerably good sheltered pasture, where no object can disturb them;

though, if this should fail, it will be advisable to give them turnips, or similar green food, under the like precautions, till within the last two or three weeks before their yeaning. In the breeding of cattle, indeed, it is a maxim which ought to be steadily kept in mind, that nothing can be more prejudicial to the females than to fatten them during gestation; and with respect to ewes in particular, this rule should be more carefully observed than with regard to any other animal; for if they be fed too high while they are going with lamb, they will undergo great difficulty and pain in yeaning; whereas, unless they are put into a little heart before that period arrives, they will not only be deficient in strength at the critical moment, but also be destitute of a sufficient supply of milk for the support of the lamb, and consequently both the dam and her progeny must be greatly weakened, if they do not actually perish from such mismanagement.

As the time of yeaning approaches, the attention and assiduity of the shepherd, (if there be one,) or of the breeder, ought proportionably to increase, as it sometimes becomes necessary to assist nature in cases of difficult parturition; and also, if in the open air, to drive away crows and similar birds of prey, which might otherwise assault the newly-dropped lambs, and pick out their eyes, notwithstanding all the efforts of the dam.

As soon, therefore, as the ewes are expected to begin to yean, they ought, every night, to be folded in a standing littered fold, on one side of which should be a warm cottage-hut, provided with a chimney, and with a stove for warming milk, and also with a bed on which the shepherd may lie down. Here he is to sleep during the lambing season, that he may be ready to watch, assist, and tend any ewes which he observes to be very near lambing, and, if necessary, to give aid to the young animal. Mr. Young, to whom we are indebted for this hint, remarks, that some considerable Norfolk farmers have such huts on four wheels, to draw about with the flock wherever they may be; but he justly conceives, that it is a far preferable method to have one littered, and well-sheltered, standing fold, on a farm of a moderate size, and two or three conveniently placed on a large one, to which the flock may be taken without any distant driving.

Further, after the lamb is yeaned, it will be necessary to

examine, as early as possible, whether it be as strong as from concurrent circumstances there may be reason to expect; for, in the contrary case, it should be housed with the dam. And, if the ewe also be weak, she should be kept on good grass pasture (as turnips, however useful in other instances, would in this case tend to make them *mortify**) till she has a proper supply of milk for her lamb, which should, in the mean time, suck another ewe.

As the feeding and fattening of sheep will form a subsequent article of discussion, and the rearing of *house-lambs* will be noticed in the next section, we shall at present only state a few hints connected with this part of our subject prior to the lamb's being weaned.

It has already been intimated, in the preceding page, that turnips are of great service in giving a flush of milk to ewes, which are not weakened by difficult parturition; and, as many drop their lambs at a very early period in the year, great care is necessary in supplying them with those useful roots, so as to insure a sufficient quantity. If the land be liable to be poached by the sheep, the best mode is to draw the turnips, and cart them to a dry pasture, where the sheep may be baited with them once or twice in the day, proper attention being bestowed that the animals eat the whole, without committing any waste; a circumstance which, if duly observed, will afford a certain criterion of the quantity necessary for each meal, or bait, while the stock of roots will be consumed in the most beneficial and economical manner. On dry lands, indeed, a different practice may, with advantage, be adopted, by eating the crop on the land, hurdling off a certain quantity for the flock; and, as they consume these pretty clean, by extending the hurdles farther. By this method, no inconsiderable degree of trouble is saved; and, on whatever land these roots are given, provided the soil be dry, great benefit will uniformly result from such practice.

During very wet or stormy weather, or in deep snows, it will be necessary to bait the ewes and their young progeny on hay. With some farmers it is usual to drive them to hay-stacks, where they meet both with shelter and with food; a measure which is by no means consistent with the economy that ought to exist in every department of farming business. By others,

* Marshall's "Rural Economy of Norfolk," vol. ii, p. 137.

again, the hay is given in moveable racks, and a stated portion *per diem* is allowed: "it is, indeed, an excellent method," observes the intelligent agriculturist, Mr. Young, "to allow them in their racks a small quantity of hay daily, while on turnips, let the weather be good or bad; but this is not absolutely necessary." He also remarks that, in some parts of the kingdom, the most experienced farmers give their ewes and lambs bran and oats, or oil-cakes, in troughs, while these animals are feeding on turnips; but the expense attendant on this practice can only be repaid by a good breed.

By the course of feeding here detailed, the sheep may be successfully supported till the month of March, after which time no intelligent breeder will allow any turnips to be seen on the ground. In fact, by the period last mentioned, the stock of turnips is generally consumed; so that every attention should be paid to have a proper supply of spring food. Among the many expedients resorted to for this purpose, may be mentioned the turning of sheep into a spot of rye sown for the purpose, or into crops of wheat, in order to feed them off; an expensive practice which, however, cannot be adopted on farms that are appropriated *solely* to the rearing and grazing of cattle. Other resources are the letting the animals run over the clover and pasture of the farm; hence the crops of hay, and pastures for large cattle, receive material injury. Further: others, with a view to avoid these extravagant practices, keep the turnips so that their shoots may become an object of sheep-food; and also have an adequate spot of land, under ray grass and clover, ready to take the ewes and lambs from turnips, before they are turned in upon the pastures. But, notwithstanding the various advantages which the last-mentioned expedient undoubtedly possesses over the former modes, as the roots become sticky and hard after the tops have sprouted, and, (to omit many other inconveniences), as it requires a great extent of ground to keep 100 lambs and ewes in this manner, *turnip cabbages*, the *rutabaga*, *green borecole*, (which, being impenetrable to frost, will shoot during the winter, and may be fed off several times,) and especially *burnet*; all afford singularly useful crops for spring feed. Of the vegetable last noticed, Mr. Young says, one acre, properly managed, will at this season yield considerably more food than an acre of clover and rye-grass. It possesses the peculiar property of maintaining its verdure throughout

the winter; so that, under deep snows, some luxuriance of vegetation may be discovered. In November, it should be four or five inches high; and, by February, the crop will gain two or three inches in growth in the young leaves, when it will be ready for sheep.

Infinitely preferable to any of these useful articles of spring feed for ewes and lambs, is *rouen*, or the after-grass, kept on dry meadows and pastures after the hay-harvest is concluded. Although a field of *rouen* presents an unpromising aspect at a distance, in colour not unlike very bad hay; yet, when this covering is removed, a fine green herbage, from five to six inches in height will appear; the whole of which is eaten with avidity by the ewes and their young progeny, who are thus supported till they are turned into the pasture.*

With regard to the best time for *weaning* lambs, much depends upon the period, or season, when they were yeaned. When a lamb is to be kept for breed in a good common pasture, it is the practice in some counties, to wean it at the end of about four months, in order that it may become strong, and that the ewe may acquire strength, and go quickly to *blossom*. In others, which are more mountainous and poor, the lambs are weaned a month earlier. But, whatever influence local customs may have in this respect, this business should be performed before the expiration of July; and, as it is of essential importance to their future growth, and consequently to the breeder's profit, that due provision be previously made, it will be proper to remove the lambs to a distance from the ewes, to such fresh food as may be most convenient. In the opinion of Mr. Young, clover, while in blossom, is the most forcing food; sainfoin *rouen* may also be successfully employed for the same purpose; but if the farmer or breeder possesses neither of these succulent vegetables, he ought at least to have re-

* The treatment of sheep when formed into flocks, and the various modes of fattening them, will be discussed, *infra*, Chap. III. Section III. Mr. Young gives it as his opinion, that *rouen* is the cheapest mode of keeping a full stock in April. If of a tolerable quality, he estimates that it will carry ten ewes on an acre, together with their lambs, through the whole of April; and computes its relative value to be, in autumn, 10s. or 12s.; in the spring from 30s. to 40s. per acre; and, if the season be backward, that a farmer who possesses it would not be induced to dispose of it for a more considerable sum.

served a sweet bite of fresh pasture-grass. On weaning the young animals, their dams may be milked two or three times, in order to relieve their udders, which would otherwise become painful.

Various ages are mentioned as being most proper for gelding those lambs which are not intended to be raised as rams for breeding; the sooner, therefore, this operation is performed, it is the better for the animal, which is more able to support it while young, and running with the dam, and when there is less danger to be apprehended, lest any inflammation should ensue.

The time best calculated for this purpose, in the opinion of the best farmers and breeders, is within the first fortnight, unless the lambs are unusually weak, in which case it will be advisable to defer castration for two or three weeks, or such longer term as may be expedient, till they acquire sufficient strength.

The *shearing* of sheep, and the profit thence derived from the wool, form a very considerable article of rural economy. The most proper time for this purpose must be regulated according to the temperature of the weather, in the different parts of this island. If the weather be hot, the month of June may be fixed for shearing, or clipping these animals, though some breeders defer it till the middle of July; under the idea, that an additional half pound of wool in every fleece may be obtained, in consequence of the increased perspiration of the sheep. An early shearing, however, is preferable, where the weather and other circumstances will admit of the operation being performed; because the new wool will not only gain time to *get a-head*, but the animal will also be secured from the attacks of the fly, to the depredations of which it becomes liable by delaying the operation.

Previously, however, to shearing, the sheep ought to be washed, in order to remove the dust and other filth which they may have contracted; this is usually performed by men standing in the water, who, not unfrequently, take serious colds, or are otherwise indisposed in consequence; while their employer is put to a useless expense, in order to supply them either with a medicated liquor, known in some counties by the name of *lamb's wool*, or with ardent spirits. To prevent these inconveniences, as well as the abuses resulting from the careless or negligent manner in which the washers do their work, Mr. Young proposes to "rail off a portion of the water," (either of

a running stream or of a pond), "for the sheep to walk into, by a sloped mouth at one end, and to walk out by another at the other end, with a depth sufficient for them at one part to swim; pave the whole; the breadth need not be more than six or seven feet; at one spot, let in on each side of this passage, where the depth is just sufficient for the water to flow over the sheep's back, a cask, either fixed or loaded, for a man to stand in dry; the sheep being in the water between them, they swim through the deep part, and walk out at the other mouth, where there is a clean pen, or a very clean, dry pasture," or rick-yard, "to receive them for a few days, until they are thoroughly dry; and fit for the shearers, the lambs being first separated from the other sheep, and confined in distinct pens. Of course," adds that enlightened agriculturist, "there is a bridge-railway to the tubs, and a pen at the first mouth of the water, whence the sheep are turned into it, where they may be soaking a few minutes before being driven to the washers."

Where, however, much dirt has fastened itself at the points of the wool, and the haw and yolk cannot be dissolved in cold water, the "Farming Society of Ireland" think it might be wise to have a large tub of water at about blood heat, in which to place the sheep, till all the wool shall be well washed and softened, and that it should be river-washed directly after. This is said to have been the more used by Lord Bantry, not with the sheep, but with the fleeces, which were produced at the Cork sale as clean as wool imported from Spain.

This process, the Society observe, would not be so troublesome as might be supposed: for the heat of the animal will keep nearly a sufficient warmth in the water, which will at all events be produced by occasionally putting in a few pails full of hot water. And it is a fact worthy of remark, that *the greater the number washed, the better will the water cleanse.**

* As the comparison of different practices, by eminent breeders, greatly tends to improve the method which any individual may be in the habit of following, the subsequent notes, relative to the practice of some very eminent graziers on the Continent, we trust, will not be deemed irrelevant to the subject above discussed. In Sweden, the business of sheep-shearing commences early in July: some breeders there simply wash their sheep in running water, while others bestow more attention upon that operation. They put the animals in shallow tubs, where they wash them with warm water and urine, and afterwards cleanse them with pure water. After they have been thus washed, the sheep are allowed to run in a meadow for two

In washing sheep, the use of water containing the carbonate of lime (pure chalk) should be avoided; for this substance decomposes the yolk of the wool, which is an animal soap, the natural defence of the wool; and wool, often washed in calcareous water, becomes rough and more brittle. The yolk is most useful to the wool on the back of the sheep in cold and wet seasons: Sir Humphrey Davy (to whom we are indebted for this fact) thinks that the application of a little soap of potassia, or pure caustic vegetable alkali, with excess of grease to the sheep brought from warmer climates to our winter,—that is, increasing their yolk artificially,—might probably be useful in cases where the fineness of the wool is of great importance.*

The *clipping*, or *shearing* of sheep, is performed in two ways, and usually in a barn, or similar shady place. The first and most antient, or common way, is done longitudinally; this mode is attended with considerable difficulty, and is seldom well executed; hence Mr. Young thinks it probable, that one

or three days, or even longer, if the weather will permit; in order that the fleece may imbibe a new yolk, which imparts a greater degree of softness and elasticity to the wool. In Silesia, the latitude of which corresponds with that of many of our finest grazing districts, Count Magnis follows the method usually practised in that province in washing wool; and which simply consists in making the sheep cross a running stream, after obliging them to plunge into the water from a pretty high bridge. The method chiefly pursued in the fine country of Saxony, consists, first, in making the sheep cross a brook or river; on the second day, in the morning, they are again made to pass through the water, in which they are dipped, in order that the fleece may be uniformly penetrated; after which they are stroked, or pressed down with the hand, beginning at the head, and thence proceeding to the extremities of their bodies. They are also led once, in the afternoon, across the stream; the fleeces are allowed two days to become dry, and on the third day they are shorn.

A shearer dispatches twenty-five sheep in one day. When an animal is wounded, the part is anointed with its excrements, or with a mixture of linseed oil and resin. The shearing ceases about three o'clock in the afternoon, that the beasts may have time to feed in the meadows, whither they are gently driven after they have undergone the operation. After the shearing, some graziers fold their sheep for two or three weeks, sending them proper rations of food.—For these interesting facts we are indebted to M. Lasteyrie's very valuable "*Histoire de l'Introduction des Moutons à Laine fine d'Espagne dans les divers Etats de l'Europe, et au Cap de Bonne Espérance*," &c. 8vo. 1802.

* Sir H. Davy's Elements of Agricultural Chemistry, p. 370, 2d edit.

or two ounces, upon an average, are left on each sheep, which greatly impedes the growth of the next year's wool. The second, and improved method, consists in cutting *circularly* round the body of the animal, the beauty of which is, in consequence of this, believed to be increased, while the work is more uniformly and closely executed. This mode has been introduced from Lincolnshire into Bedfordshire by the late Duke of Bedford; by Mr. Coke, of Holkham, into Norfolk; and by the Earl of Egremont into the county of Sussex; whence its utility and convenience will probably be a means of dispersing this practice into other grazing counties.

Previously to the sheep being handed over to the shearer, it is recommended that a person should clip off all coarse and kempy wool from the hips, legs, pate, and forehead, and keep it apart from the rest of the wool, in a bag or basket. This is particularly necessary to be observed in the shearing of lambs: for, in lambs' wool, if the coarse part and kemps be suffered to mix with the fine, they never can be sorted out, and must spoil any fabric to which the wool may subsequently be applied, as the kemps will not take any dye; and whatever colour may have been intended, the article must be a mixture. Further, great care should be taken, in shearing, not to give the wool a second cut, which materially injures and wastes the fleece.

During the whole process of washing, as well as of shearing sheep, it will be advisable for the farmer himself to superintend those operations; and especially to see that the clipper does not wound, or prick the animal with the edge or point of his shears; otherwise the flies, abounding in the sultry heats of midsummer, will instantly attack the sheep, and sting them to very madness. The same precautions are applicable to the shearing of lambs, which are usually washed and clipped about five or six weeks after the rest of the flock, though such practice is disapproved by some breeders, who accordingly shear the whole at the same time. And lastly, it will be requisite that he see the wool carefully clipped off, and properly wound up, lest any impure particles, or extraneous substances be mingled with the wool, the sale of which might otherwise be injured. For this purpose, the respectable Society above mentioned recommend the fleece, when shorn, to be spread at large with the outside uppermost, upon a platform of boards: it is then

to be carefully folded and rolled, beginning at the hinder part, and folding in the sides, or belly wool, as the rolling proceeds. When arrived at the shoulders, the wool of the fore part is to be rolled back to meet the other, instead of having the binder twisted from thence in the usual manner; and the whole is to be secured by a pack-cord band, in the common way in which parcels are tied up. Thus the fleece is kept much tighter together, and unfolds itself with more regularity under the hand of the sorter, who is otherwise much inconvenienced by the confusion or breaking of these parts of the fleece, which in the common method are twisted together for the band.

In the preceding details, we have spoken of one annual shearing; but experiments have been made by some enterprising breeders, tending to show that, in certain cases, long-woolled sheep may be shorn *twice*, and even *three times* in the year, without the animal receiving any material injury. And Mr. Ellman, a spirited farmer of Glynd, in Sussex, clips off the coarsest wool on the thighs of his South-down flock, (the first of that breed in this island), and docks them about four weeks before the usual time of washing and shearing. The wool, thus severed, he sells, as locks, for $3\frac{1}{2}$ d. per pound, each sheep yielding, upon an average, four ounces. He is said to find this method very beneficial, as the animals are kept clean and cool during hot weather; and from the success with which this method was practised, it has been adopted in other counties with different breeds of sheep.

A more singular mode has for some years been tried at the French national farm, at Rambouillet, the result of which is stated to be that the fleece of sheep improves greatly by being suffered to grow for several years; and that the fleeces of some sheep, which were shorn in 1804, for the first time for *three* years, and in 1814 for the first time for *five* years, were equal, in point of staple, to those which were annually shorn, and produced a larger sum. We state these facts for the consideration of the philosophic breeder; though, with regard to the last experiment, we confess ourselves at a loss to reconcile the idea, of the very great degree of heat which the French sheep must have felt with such a weight of wool; especially, as it is the opinion of all well-informed breeders, that excessive heat is equally hurtful to sheep as extreme cold. Beside which risk, it may be observed,

that he who should in this country attempt such an experiment, would be liable to lose no small portion of the profit to be derived from the fleece, by the latter being torn by hedges, thistles, &c.; unless, indeed, the experiment were conducted in a small inclosure expressly made for the purpose, and even then it is more than probable that it would fail.

After sheep have been clipped, it is usual to mark them with ochre, tar, ruddle, or other colouring matter; but, as it sometimes becomes difficult to wash the stains of these substances out of the wool, another composition was suggested by the late Dr. Lewis. It is prepared by mixing finely-pulverized charcoal, or lamp-black, (which is better, where it can be procured,) with such a quantity of tallow, over a moderate fire, as will produce a black colour, and a proper consistence; and, with the view of rendering this preparation more durable, Dr. L. states, that one fourth, sixth, or eighth part of tar, may be incorporated with the tallow; and that wool, which has been marked with such mixture, may easily be cleansed therefrom, by washing in strong soap-suds. It has also been recommended by an intelligent correspondent, to besmear the roots of the wool, immediately after the sheep are shorn, with an ointment composed of sulphur and butter, which is to remain on the animal for three or four days. At the end of that time the sheep are to be washed with salt and water. The advantages stated to result from this practice are, a very considerable improvement in the softness and fineness of the quality, and also an increase in the quantity produced; besides which, the unguent operates as a coat to the animals immediately after shearing, and thus prevents them from taking cold in exposed situations after being stripped of their fleece. A simple washing or rubbing them over with tobacco-water, however, has been found sufficient in a high and cold tract in Scotland.*

In cattle farms, in general, it is of great importance to dispose, at certain times, of such beasts as either become unprofitable, or are sufficiently fat for sale; and with regard to sheep, in particular, it is highly necessary to pursue the same management, and to replace old ewes, by an equal number of the best and most vigorous female lambs; in order that the value of the flock may not be diminished. In the southern counties of this island, the severing of sheep usually takes

* Farmer's Magazine, No. XXXVIII.

place about six, eight, or ten weeks after the shearing is finished, or in the course of the middle of August. In making this selection, great care should be taken to choose those only which give indications of their being of the true breed, (whatever that may be); and, according to their comparative strength or weakness, to regulate their pastures. Hence it will be proper to place those animals which are designed for feeding or fattening by themselves; the ewes by themselves; the *wedder* or *wether hogs*, (i. e. males, whether castrated or not, that are of one year's growth), and *theaves*, or females, that are two years old, by themselves; and the old wethers and rams by themselves; and lastly, the lambs by themselves; otherwise the stronger animals will injure such as are weak, and prevent them from taking that food which would be most beneficial for them.

When a farm is thus stocked with a proper assortment of sheep, it will be necessary for the owner to inspect them often, at least twice in the year, particularly in the winter; and, if the severity of the weather or season have proved fatal to any, he should replace them with others from sound flocks, and as nearly of the same size, quality, and property, of his own stock, as the difference of circumstances will admit. At such annual, or half-yearly musters, it will also be proper to dispose of those animals which do not thrive upon their allotted grounds; but, independently of these examinations, the shepherd ought constantly to continue with his charge; as they are liable to various maladies, which (if not speedily attended to) will carry them off in a few minutes.

SECTION VII.

Of the Treatment and Rearing of House-lambs.

IN the preceding section, the treatment of lambs intended to be kept for stock, has been chiefly regarded; but, as the price given in the winter, in the metropolis, and in other places where there is a demand for young lambs, is often very considerable, we shall, at present, confine our attention to the rearing of those animals in the house, where they are denominated *house-lambs*.

In this branch of rural economy, two circumstances are worthy of notice: 1. To put the rams and ewes together, at such a time, that the lambs may fall at the proper season; an object which may be easily effected by any skilful shepherd: and, 2. That appropriate places be provided for their reception. Where the suckling of house-lambs is intended to be regularly followed, it will be necessary to erect a house of such proportions as the probable extent of the business may require, and to divide the building into stalls, in order that each lamb may be more conveniently suckled and confined. Care should also be taken, not to crowd too many into one house at the same time; as the increased degree of heat, thus occasioned, will render the place unwholesome.

The breed of ewes, best calculated for producing house-lambs, is the early Devonshire sort, particularly those whose flesh lambs die *fair*, in the language of the flesh market; i. e. whose is of a delicately-white colour: and from this prolific variety the demands of the luxurious in the metropolis are supplied. The dams in that county are fed with hay, oil-cake, corn, cabbage, or any other green food afforded by the season; which is given in an inclosure adjoining the apartment where the young lambs are confined. The last are shut up in small dark cells, from which the light is excluded: excepting at the intervals when the shepherd suckles them upon the ewes.

Where the system of suckling is carried on to a great extent, it will be advisable to mark the lambs, in order to ascertain which has been longest sucking on the *bastard ewe*, (i. e. such as suckle strange lambs, or have lost their own); as such lambs ought to *suck a-head*, or be permitted to take the first milk.

As the ewe's milk is the chief support of the young lambs, (though, in the intervals of suckling, some wheat straw may be given them in racks, or wheat or white peas in troughs, together with a piece of calcined chalk for them to lick, and thus preserve them in health,) especial care must be taken to supply her with turnips; or, in case these roots cannot be procured, besides turning her into a good warm pasture, she should be fed with brewer's grains, to which may be added a little hay, oats, or bran; but, as the last-mentioned articles are greatly inferior to turnips, it becomes an object of importance to obtain a supply of those useful roots.

The ewes ought to be conducted to the lambs three or four

times in the day, at nearly equidistant periods; and if any one have a more than ordinary flow of milk, she may be held by the head, while another lamb, which has a less quantity, draws the udder. During the whole of the treatment, the strictest attention ought to be paid to *cleanliness*; to promote which, the pens or stalls should be well littered with fresh straw; and, by this simple expedient, the animals will, *if kept free from all disturbance*, speedily fatten, their flesh being exceedingly white and delicate. Some estimate may be formed of the profit arising from rearing house-lambs, from the prices given *per quarter* in the London markets. These vary from ten to fifteen, or twenty shillings, according to the demand, so that each lamb sells at from two to four pounds; though the prices afterwards gradually decline, till the ensuing spring affords an abundant supply for the table.

SECTION VIII.

Of the Hog.

AMONG the various articles of live stock, few are more profitable to the breeder than *swine*, while the number kept on a farm is proportioned to the quantity of offal on the premises; especially as the attendance they require is, when compared with that of others, very trifling, and the benefit arising from their dung more than counterbalances the expense of such attendance. It is only of late years, however, that the prejudices against these animals have been done away in Scotland, and the counties bordering on England; and they are now both profitably and successfully reared in those districts.

The characteristic marks of a good hog are, a moderate length, as to the carcase in general; the head and cheek being plump and full, and the neck thick and short; bone fine; quarters full; the carcase thick and full; his bristly hide fine and thin; the symmetry or proportion of the whole well adapted to the respective breeds or varieties; and above all, a *kindly* disposition to fatten early.

On account of the numerous sorts and varieties of these animals, found in almost every country, it is scarcely possible to ascertain which are the original breeds; in the introductory

view prefixed to this work, it is attempted to arrange those which are of most frequent occurrence, and are held in the greatest estimation.

Swine are capable of propagation at eight or nine months; but the boar should be at least twelve months before he is admitted to the sow, which will farrow a stronger and better litter, if she be kept to the same age. The period of gestation is from seventeen to twenty weeks; when from five to ten, or more pigs, are produced: one boar should not be allowed to serve more than ten sows; and those sows are reckoned the best for breeding strong pigs which have about ten or twelve paps.

Where swine are kept solely for the purpose of *breeding*, it is necessary to pay the same attention to the principle of *selection* as in other articles of live stock. Hence, whatever sort may be required, the boar and sow should respectively be chosen with as perfect a symmetry and other requisites as are practicable; and also be as well kept, in order to produce the necessary stimulus to coition: and, having attained this object, the stock should be constantly raised from such animals. But, as with other cattle, care must be taken that sows, when expected to take the boar, be not kept too fat; experience having shown that, if they be in very high order, they will not produce an abundant litter of pigs.

Further, as some will produce two litters in the year, the breeder will find it beneficial so to arrange each time of farrowing, that it may take place about the latter end of March or early in April, and towards the beginning or end of August: thus he will be enabled to rear them with less cost, and certainly with less probability of losing the pigs from cold weather, than if they were produced late in autumn: and, while the sows are in pig, they will require to be kept on nutritious food, in order that they may afford the pigs a better nourishment. They should also be kept well littered and clean; but at pigging should not be allowed too much, as they are apt to overlay their pigs in it, for the first week. At the end of a week or ten days after pigging, they may be let out of their sties into their yard, for three or four hours during the middle of the day, in order to stretch their legs, which is far preferable to total confinement.

It sometimes happens, at the first farrowing, that young

sows will eat their progeny ; to prevent which, they should not only be narrowly watched, as the period of gestation is expiring, but also be moderately fed, two or three days before the expected time of farrowing. Where, however, this precaution has been omitted, it has been recommended to wash the backs of newly-farrowed pigs with a sponge, dipped in a lukewarm infusion of aloes and water, which will prevent her from destroying them. Another circumstance worthy of notice, where there are several sows farrowing at the same time, is to confine them in separate pens or sties, otherwise they will mutually destroy their offspring ; and, as these animals are, at such time, extremely mischievous, let them be supplied with plenty of water, which expedient is said to prevent them from committing any injury.

The best time for killing *sucking pigs*, for the market, is at the end of three weeks ; by which time the others intended to be raised, will be able to follow the sow, and then the males may be castrated ; the spaying of females may be deferred for another week.

When it is proposed to wean pigs, (the proper age for which purpose is two months, having castrated such as are not reserved for breeding at six weeks,) they should, Mr. Young remarks, be kept in sties, having a small yard wherein they may run ; both being kept perfectly clean and well littered. Their food must be good, and given as plentifully as they will eat. Boiled potatoes or carrots for a fortnight, and then raw ones, will prove good food ; with a bait every day, for a month, of oats, and afterwards pea, or bean, or buck-wheat meal, unless there is a dairy ; in which case, a mess of milk or whey may be substituted. Such, in his opinion, must be the management, till the clover-field is ready for them, which may be in the beginning of May ; and, if the pigs are three months old, they will thrive well on that food. During the weaning, especial care ought to be taken in supplying them with abundance of clean straw, and to keep the pigs in as clean a state as possible, so that they may always have fine sleek coats ; a circumstance this of such consequence, that the want of it can never be compensated by the most plentiful supply of food.

In the management of swine, of whatever breed or variety they may be, it will be proper to have them *well ringed*, to prevent them from breaking into corn-fields during harvest ;

and that operation ought to be performed as early as possible, or the practice recommended by Mr. Tubb, a spirited breeder, at Lord Somerville's cattle-show, in 1805, may be substituted in lieu of ringing. It consists simply in shaving, or pairing off, with a razor or sharp knife, the gristles on the top of the noses of young pigs; the place soon heals over, and they are thus rendered incapable of that destructive rooting, or turning up of the ground, which farmers find so detrimental to sward land.

Lastly, sows may be allowed to breed till they are six years old; and a boar to serve them till he has passed his fifth year; after that time, the former may be spayed, and put up to fatten, and the latter may be castrated, as he is then no longer fit for generation, though his flesh will make excellent bacon. Throughout the management of these animals, the strictest regard to *cleanliness*, as already intimated, should be observed; for, notwithstanding they are, when left to themselves, proverbially filthy, it is certain that they will uniformly thrive better, and more speedily, if the sties are kept clean and well littered with straw; the expense of which will be more than compensated by the value of their *dung*; which, as well as every other species of filth, ought carefully to be removed.

Having thus specified the chief articles connected with the breeding of these animals,* we shall mention a few hints, which may contribute to guard the unsuspecting purchaser against imposition, in buying and selling swine at markets, both in a *fat* and *lean* state. In the former case, it appears, from actual and repeated experiments, that every twenty pounds of live weight will, when killed, produce from twelve to fourteen clear weight. Where the hogs do not exceed twelve stone, of fourteen pound to the stone, the weight will be twelve pound; if they be of a larger size, it will be, upon an average, about fourteen pounds; so that, if a farmer or breeder weigh his beasts while alive, he will be enabled to ascertain the net profitable weight when dead; and likewise, by weighing the hogs every week, to fix the best time for disposing of them to advantage: because, as soon as an animal ceases to acquire that daily increase which makes it beneficial, the best step that can be followed is to sell, or slaughter him without farther delay.

* The best modes of feeding and fattening of swine will be discussed *infra*—Chapter III. Section IV.

With regard to the buying of hogs in a *lean* state, the most certain criterion, by which any judgment can be formed, is by weight; and, therefore, if a few lean pigs, of the same size as those intended to be purchased, be previously weighed, a standard will be obtained, which will enable the purchaser to decide with some precision, and, consequently, to offer a proper price in the market.

CHAP. II.

FARM OFFICES.

SECTION I.

The Farm House.

ACCORDING to the manner in which husbandmen usually acquire possession of farms, it rarely happens that they have it in their power to place, or to erect, a *farm-house* in such a situation, and with such offices, as convenience and other circumstances may require. Where, however, a farmer has, either by descent or purchase, a farm at command, or the old mansion is so much decayed that a new dwelling is preferable to making any repairs, it will be highly necessary, first, to consider the expense of the improvements proposed; this, indeed, is various in proportion to the value or rental of the farm, and may be computed to require one or two years rent, where the farm is let for 60*l.* or 70*l.* a year, exclusive of the dwelling-house. In cases where the annual rent is from 300*l.* to 400*l.* it has been estimated that one year's rent will, upon an average, be amply sufficient for a mansion: and in farms of greater extent, 500*l.* are allowed for this purpose; and 1,000*l.* or 1,200*l.* for the requisite offices.*

* These calculations are of a general nature, and of course must necessarily vary according to existing circumstances. The inquisitive reader will meet with numerous useful estimates of farm-building, in the first volume of Communications to the Board of Agriculture. Probably, an addition of 30 per cent. at least should be made to the estimates above mentioned, for the difference of circumstances between the year 1808 (when they were first written) and the present time.

The other objects necessary to be attended to in erecting farm-houses are, a *salubrious situation* and *convenience*; points of infinite importance, as they materially affect the health and welfare of every individual.

Independently of the general salubrity of the place where farm mansions are proposed to be built, the nature of the *air* and *water* requires particular notice; the former should be pure and temperate, the latter wholesome and easily obtained. The most healthy spot, therefore, ought to be selected for building the house; which, where choice of situation can be commanded, should be as nearly in THE CENTRE OF THE FARM as circumstances will allow, and be exposed neither to the summer heats, nor to the rage of the winds and storms that prevail during winter. Many parts of our fertile island abound with rivulets and streams, which however are rarely regarded, though attention to this point is of the greatest importance. Hence a gentle elevation will be found greatly to conduce to the advantage of the farm-house, as well as to convenience of carriage; and where a quick-flowing stream has a clean channel and dry banks, it will add considerably to the beauty and salubrity of the place. An elevated situation, indeed, is not only healthier for the farmer, his family, and servants; but the carts will bring home the grain, and in harvest-time, with least waste, when going up hill; and when empty, they can return to the harvest field in very urgent cases with a quicker step, which will greatly expedite the housing of the farm produce. The manure from the farm-yard so situated, will all be conveyed down hill to the fields in the cheapest and most expeditious manner: but, what is of more importance yet, the farmer, whose eye ought to pervade every place and every thing, if possible, will thus be enabled to see what is going on all around him.*

With respect to the situation of the house, as it regards proximity to the various offices, it has been laid down as a general rule, uniformly to select the three most exposed sides of a square for these, while the southern aspect is left open to admit the sun and air. Where, however, a farm-house is unavoidably to be built in the vicinity of streams, which are

* Sir John Sinclair's "Account of the Systems of Husbandry in Scotland," vol. 1, p. 14, to which very valuable treatise, the present edition of our work is indebted for several important hints.

over-run with weeds, or other strong grass, affording a secure shelter to every kind of filth, it will be advisable to choose a northern aspect; for the north winds blowing more briskly than those from the south, the air is in general cool, putrefaction is checked, fewer noxious vapours will arise, and these will be speedily dispersed by reason of the greater density of the air.

Further, where convenience and other circumstances will admit, it will be best to erect the house at a moderate distance from the respective offices, say from thirty to forty yards, and so to arrange the rooms commonly occupied for sitting, or working, as to command a view of the business carrying on both in the house and abroad. Both the house and offices should be on a size and scale adapted to the size and produce of the farm, keeping *utility* always in view, though not to the exclusion of ornament, where the nature of the country will admit of it, without incurring much extra expense in building and laying out the grounds.

The following circumstances are stated by Mr. Young, as being essential in planning a farm-house.

- I. The kitchen ought not to be a thoroughfare, nor should any house-door open directly into it. The scullery ought to be as near it as possible, but without opening into it.
- II. The mistress's store-room should have a square opening into the kitchen (with a sliding door,) on a level with the dresser or broad shelf that surrounds the store-room, through which she may give out whatever is wanted, to prevent the necessity of frequently passing by a circuitous way.
- III. The common *keeping* or *sitting-room*, ought to open on one side into the store-room, and on the other into a passage leading directly to the cellar, which should be at a small distance, in order that the eye may attend what the hand need not perform.
- IV. The window of the *keeping-room* should look full upon the grand avenue to the yards, cattle, &c. and, if possible, at a safe distance, full into the farm-yard.
- V. The farmer should have a store-room, as well as his wife, for sacks, small tools, nails, &c.

In Plate I, figure 1, (See the Frontispiece) we have given a

plan of the ground-floor of a farm-house, which, on reference, will be found nearly to correspond with these rules of Mr. Young. With regard to the arrangement of the upper apartments, much will depend upon the fancy or wishes of the builder; let it, therefore, suffice to state, that the farmer's bed-chamber should be placed in an eastern exposure, with a large window facing full to that quarter, in order that the rays of the morning sun may early enter it; and every attention ought to be paid to keep the servants' apartments well ventilated, as a considerable portion of unwholesome air must be evolved from numerous persons sleeping in the same chamber, a circumstance that cannot be avoided in farms of considerable extent. The party walls should be raised above the roofs of the offices, *to prevent the communication of fire*, especially where the farm-offices are *thatched*.

Before we proceed to discuss the various offices essential to a grass or dairy farm, it will be proper to annex a few hints on the time best calculated for building, as well as on the most useful way of covering the roofs of farm-houses.

For the first of these purposes, the month of April is preferable, especially where masonry work is requisite; for there is no point in building more necessary to be attended to, than that of finishing at as early a period of the summer as possible, in order that the mortar may have sufficient time to dry before the approach of winter. An exception, however, may be made with regard to the farm-yard and offices, which, where repairs are wanted, cannot be done too soon, as they rank among profitable improvements.

The roofs of farm-houses are, for the most part, thatched with straw; instead, however, of adopting this mode, it would be greatly desirable that they should be uniformly covered with slate, or tiles, in all situations where these articles can be procured. But where neither slate nor tiles can be obtained, heath or ling, as it is sometimes called, is preferable both for farm-houses and for out-houses. This vegetable, when well laid on by a judicious thatcher, is superior to straw; and at the same time so cheap, that in any place situated in the vicinity of heaths, or wild commons, it may be had for the mere labour of carting it to the premises.

SECTION II.

Farm-Offices.

No article of rural economy, is of greater importance than the judicious disposition of the offices, or out-buildings necessary to the successful management of a farm ; yet there is, perhaps, less consideration bestowed on this point than on any other. It is obvious, however, to the most common observer, that the size of the various out-houses ought to be regulated by the extent of the farm to which they belong, and also by that branch of husbandry which is more particularly carried on. In a grazing or dairy farm, indeed, there are fewer offices requisite than in any other department of agriculture ; but it is, nevertheless, highly necessary to have distinct buildings for the various sorts of cattle ; and the whole of these should be so distributed, as to facilitate the labour and convenience of the servants. Further to facilitate this object, the surface or bottom of the yard should be as level as possible, and, where chalk can be commanded, bedded or coated with it, or with some other material impenetrable to water ; by which means the filtration of urine, or moisture, in the smallest degree, will be effectually prevented, and consequently a great saving obtained in the article of *animal manure*. Of the principal offices requisite to a farm of this description, we now proceed to give an outline, referring the reader to Plate I. for a general view of their arrangement.

§ 1. *Ox-Stalls, or Feeding-Houses.*

The structure of these buildings is very simple : of those used in the extensive grazing districts of Lincolnshire, (where they are usually denominated *mistles*,) Figure 2 of Plate I. will exhibit a tolerable idea ; it is, however, requisite that each interval, or stall, should not only be provided with a trough, or crib, for dry food, but there should also be, in the centre of each, a vessel, or trough, for the reception of water, which salutary fluid may be conducted into them by means of tubes leading

from the pump, if this be contiguous: and through which it may be poured from buckets, &c. where that convenience does not exist. The size must depend upon the manner in which the farm is occupied: but it ought never to be forgotten, that the beasts should have *ample accommodation*.

In order to erect feeding-houses, or ox-stalls, to advantage, great attention should be bestowed on their situation, which ought to lie dry, and not be exposed too much to the sun, or to the heat of the weather. It will be advisable to lay the floors in a *gently-sloping* direction, with proper drains for carrying off the urine, and also for the more easy removal of dung and other filth. The floors are variously paved: by some it has been recommended to have the pavement of stone pitched; but the least expensive method is, to lay the floor with Dutch bricks, or *clinkers*, as they are sometimes called, and which are usually employed for flooring or paving stables. The doors also should be so hung as to open outward, by which means a waste of room will be prevented, and the sheds will be rendered more secure against intruders. Their safety will also be greatly increased by hanging them with a fall to the catch; and, to prevent them from receiving any injury by the weather, when open, they should also have a fall backward, under the eaves of the building. This desirable object may be effected by placing the *balance-point* in the midway between the two extreme positions of the door, which, being set at a right angle to the line of the building, has a fall to either hand.*

The *width* of stalls is various: for two middle-sized Devonshire working oxen, Mr. Marshall conceives *seven* feet to be sufficient, and *nine* feet for those of a larger size. Cows, though in general smaller than oxen, require equal, if not more room for the conveniency of milking them as well as of suckling their calves. Much caution is necessary in constructing stalls, that they be not made too wide, lest the cattle turn round in them; and thus the stronger beasts will have an opportunity of injuring their weaker fellows. But this danger may be avoided by placing a post in the middle of the stall, immediately before the shoulders of the cattle, in a line with the front posts of the

* Marshall's "Economy of the West of England," vol. ii, p. 319.

partial partitions ;* in which place a post may be found useful, to fasten calves to while sucking.

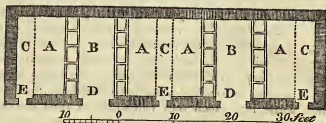
The health of cattle being a circumstance of the greatest importance, especially where the system of stall-feeding is adopted on a large scale, it will be necessary that there be a regular temperature maintained, as the confined respiration of many animals must necessarily tend to generate diseases. Hence, though a loft may be built over the stalls for the reception of provender, &c. it will be advisable to construct latticed windows, or apertures, at a considerable distance from the ground, at the gable ends of the feeding-houses, and to supply them with shutters, which may be closed or withdrawn as the season of the year, or the temperature of the weather, may render this necessary. Further, where it is practicable, such openings should be towards the north or east, in order that they may derive some benefit from the genial rays of the morning sun, and from the cooler air of the day in summer; beside which, the large front doors may sometimes be set open during the winter, in order to admit the sun, or warmer air.

Notwithstanding the obvious utility of free ventilation in feeding-houses, there are not wanting instances of persons who recommend a contrary practice; and, singular as it may seem, assert that the tendency of animals to become fat is materially promoted by *sweating* them. This mode of treating cattle has been tried on an extensive scale, by Mr. Moody, a spirited breeder of this island, who avers, that the hotter cattle are kept the better they will fatten. He, therefore, shuts them up in a feeding-house, into which no air is allowed to enter for some time. In consequence of the heated breath of so many beasts, a most profuse perspiration is produced; and when this is at its highest point, they fatten most speedily. After thus sweating for about a fortnight, the pile or hair falls off, and is replaced by a fresh coat, after which the animals sweat no more; those cattle, however, which do not sensibly perspire, seldom grow fat.

As in every building convenience is a primary object of consideration, so in farm-offices in particular this point demands minute attention. In addition to the cow-house,

* "Midland Economy." vol. i, p. 33.

feeding-house, or *mistle*, as ox-houses are variously termed, the following plan of a similar building, much used in the county of Roxburgh, in North Britain, may not improperly be annexed.*



The feeding-byre here delineated is sixty feet in length, by eighteen in width, and is capable of containing twenty cattle standing across the house, with their hinder parts towards each other; while a sufficient interval is left between them for storing up turnips, or other winter food. AAAA represent four spaces for the cattle, five being allotted to each, and which may be fitted up either with cribs or with stone troughs. BB designate two spaces for receiving roots, each interval being eight feet wide; they are separated from the troughs, or cribs, by means of strong wooden partitions, (for which a thin party-wall is sometimes substituted) from three to three feet and a half in height. DD, the doors, are sufficiently wide to admit a cart to be backed in, and turned up; over this low partition the turnips, or other roots, are thrown to the beasts. CCC are passages four feet in breadth, behind the animals, for the purpose of removing dung and filth by means of the doors, which are respectively marked E E E. Should a particular situation require, or render it convenient, the large door just noticed may be disposed in the back of the feeding-byre, or ox-house.

Although the plan above delineated is calculated for twenty beasts, it may be adopted with equal ease, where ten, or even a smaller number, are kept; for, on supposition that five feeding-

* Similar edifices, called *Hammels*, or *Hemmels*, are much used in Berwickshire. See them described and illustrated in Sir J. Sinclair's *Husbandry of Scotland*, vol. 1, pp. 25, 26, and vol. 2, Appendix, p. 192.

cattle are placed on one side, and a similar number of young beasts, or milch kine, are arranged on the opposite side, the green tops of turnips may be thrown on one side to the young animals, while the roots are cast on the opposite side to those which are fattening.

Beside the regular feeding-houses, whose plan and construction have been thus briefly detailed, it will be greatly conducive to the grazier's interest, to have the roofs of these buildings project forward, on the back front, to such a length, (such roofing being supported, at the extremities, by strong wooden posts, or pillars,) as to afford a kind of open sheds for the use of store cattle, into which they can withdraw from the straw-yard, during the summer heats. The beasts may be respectively separated in the same manner as in cow-houses, a similar interval being allowed for each, and the floor being also laid on a gentle descent, not only for the convenient removal of urine and excrement, but also for the ease and comfort of the cattle.

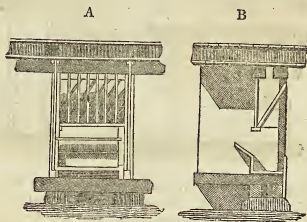
§ 2. *Stable.*

In constructing stables, as in feeding-houses, the principal object is the situation, which should, therefore, be on an airy, healthy spot, not exposed to putrid or noisome exhalations, and on dry, hard ground. The walls ought to be of a moderate thickness, and supplied with casements on the eastern and northern sides, not only for the admission of air, but also to receive the benefit of the rising sun. Shutters should, at the same time, be furnished for the purpose of excluding the light, if necessary, during the day-time.

Few objects are less attended to in building stables, than the arrangement and formation of the mangers and racks. These, according to the common practice, are needlessly extended across the upper end of the stall; thus much provender, by being drawn down and trodden under foot, is consequently wasted.

This inconvenience is not peculiar to the stables of Britain; it equally prevails in America, where two spirited farmers, of Philadelphia county, have contrived stalls that not only prevent the unnecessary consumption of food, but also contribute wholly to preserve horses from the dangerous consequences arising from hay-seeds falling into their eyes and ears.

The first of these which claim our attention, are the racks of Mr. William West's stalls: they are upright, and the perpendicular falls on the inner edge of the trough below, which has a shelving leaf, as delineated in the annexed figures; A representing the elevation of the stall, while a transverse section of the same is delineated at B.



When a beast pulls out the hay, some will fall on the leaf, and thus slide down into the trough, where it is secured from the breath of the animal. The distance between the bottom of the rack and the trough is sufficient to permit the animals' heads to enter, in order that they may get at the dropped hay. The racks are two feet four inches deep, and two feet at the top, from the edge of the rack; they are planed within, so that the hay falls to the bottom of the rack, in proportion as it diminishes in quantity, and the cattle are saved the pain of a long reach, which they are obliged to make in the stables built after the common way. It should be observed, that Mr. West feeds from the entry, which is six feet in width; and that the hay is dropped through a trap-door from the store above.

Equally useful and economical, in the article of food, are the racks of Mr. J. Cooper's stalls, the construction of which the following delineations will explain.

Fig. 1.

Fig. 2.

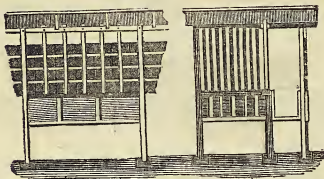


Figure 1 is an elevation, and figure 2 represents a transverse section of Mr. C's stall. The benefit to be derived from it is very great, as the upright *slats* prevent the horses from wasting the hay, as well as from blowing on it. By this contrivance the animals are prevented from looking round, a habit to which horses are much accustomed when any person enters the stable; neither can they thrust their heads over the whole trough, as the *slats* compel them to feed directly before them.

With respect to the *paving* of stables, it will be advisable to cover the part on which the horses are to lie down with *oak boards*, disposed transversely upon a level; and these ought to be pierced with numerous holes, for conducting the urine from the *stall-drain* into the common or main drain. The other part should be paved with small stones, sloping about an inch and a half, or two inches, towards the perforated boards; and the adjacent wall ought to be lined with a wainscot of sound and well-seasoned oak.

The *width* of the stalls is necessarily regulated by the number of cattle intended to be kept: where a stable is intended to receive many horses, each stall should be of a sufficient width, (five feet, at the least,) to enable them to lie down, or turn round without inconvenience; at the same time it will be requisite to elevate the divisions near the head, so that strange

horses can neither smell, see, nor molest each other. Throughout the whole course of the stable-management the utmost cleanliness must be rigorously attended to, in order to preserve these useful animals in perfect health; hence the farmer will find it greatly conducive to the ease and regularity of this branch of economy, to appropriate some part of the loft, or room above, for the reception of corn; the distribution of which may be greatly facilitated by means of a hopper, or tube, communicating with the manger by means of an aperture; and also to provide a convenient part of the stable for keeping the necessary *gear*, or harness.

Lastly, as the efforts of the industrious farmer to preserve his stalls in a proper state of cleanliness are sometimes frustrated by vicious animals discharging their stale and excrements into the manger, we shall conclude this article with a concise account of an expedient successfully employed by Mr. Morgan, an enlightened agriculturist of the Western Hemisphere. For this purpose, his stalls have a fixed iron-chain, by way of a halter, which is fastened to a *standard*, morticed into the front side of the manger, and the joist above. It is composed of two parts: one of these has sixteen links, and is two feet in length, measuring from the staple; the other, which contains twenty-six links, measures about thirty-nine inches, and serves as a collar. At one end of this *collar-chain* there is a ring, about one inch in diameter, and at the opposite extremity a key, three or four inches in length, having a hole at its middle, by which it is joined to, and freely plays in the last link. The first chain, which by one end is fixed to the manger, is by the other linked into a middle link of the collar-chain, and thus forms two arms, which, being thrown round the neck of the beast, and the key being thrust through the ring, and placed at a bar across it, makes a very secure fastening.

§ 3. *Barn.*

In those farms where corn-husbandry is chiefly practised, barns become essential articles; where, however, dairying, or cattle-grazing prevails, they are of less moment; and, perhaps, every advantage that can be derived from these buildings may be obtained by constructing a chamber-barn, or large

chamber, with ventilators and a strong oak floor over stables. But in case it is necessary to erect new barns, care should be taken to make the floors dry and firm, for which purpose oaken planks are preferable to any other material. There should also be a sufficient number of apertures, through which hay, &c. may be housed; and thus many of the inconveniences will be avoided, which must otherwise result from drawing loaded vehicles into the barn.

The following plan of a barn, which is one of the most advantageous hitherto submitted to the inspection of agriculturists, was drawn up by Mr. Young, for the use of the late General Washington, who had requested him to furnish the draught of a barn, and the necessary out-buildings for a farm of 500 acres.

The inner width of the barn is twenty-seven feet square, on each side of the threshing-floor; the porch is eleven feet four inches by twelve feet three inches; the threshing-floor thirty-nine feet by twenty on its upper end, and twelve feet and a half at the small door of the porch, which is six feet and a half in width: the great door, at which the carts enter with grain, is fourteen feet nine inches; the sheds for cattle, on the longitudinal sides of the *bays*, are twenty-seven feet by twelve; the mangers are two feet broad, out of which the cattle eat their food; the passages for carrying straw from the threshing-floor to feed the cattle, are between two and three feet wide, each passage has a door; there are four principal posts to each shed, beside the smaller ones, and gutters for conveying the urine to four cisterns, whence it is every day thrown upon dunghills placed at a convenient distance; from the mangers to the gutters there is a sloping pavement of bricks, laid so as to terminate six inches perpendicular above the gutters; this pavement is six feet broad from that edge to the manger, and the gutters are from eighteen to twenty inches in breadth. At each of the four corners of the threshing-floor there are four sheds for various uses, and at each end of the barn there are two yards with a shed, to be applied to any purpose wanted; one for sheep, surrounded with low racks, and the other divided for a horse or two, loose if necessary; the other half is for yearling calves, which thrive better in the farm-yard than when stalled. The yards just mentioned are inclosed by walling, or by pales. The main body of the barn rises fourteen, sixteen,

or twenty feet, to the eaves. Against the walling are various sheds for the reception of cattle. If the number of cattle intended to be kept be greater than here admitted, a circular shed may be erected fronting the small door of the porch, and the hay-stacks be conveniently arranged near the sheds appropriated for cows, horses, or fat cattle.*

§ 4. *Cart-House and Tool-House.*

Among the smaller buildings incident to a farm, a house for the reception of the tools and implements, when not actually employed, is not the least worthy of notice; though it not unfrequently happens, that such instruments are heedlessly left on the spot where they are last used. And, as these consist chiefly of wood-work, the building allotted for this purpose ought to be so contrived, as to afford a secure shelter from rain, while the implements are thoroughly exposed to the ventilation of air. Hence an open spot, free to every wind, should be selected for this purpose: the roof ought to be supported on pillars, and the sides similar to those of dry-inghouses, in bleach-fields, with moveable boards for admitting air and excluding rain. An open space, of about three feet, may be left towards the bottom, as at that depth the rain cannot penetrate so as to be productive of any injury. Previously, however, to depositing any implement in this place, it ought to be carefully cleaned and dried.†

§ 5. *Calf-Pens.*

In some parts of this country, it is the practice to appropriate a part of the cow or feeding-house to the reception of calves; a measure which cannot fail of producing uneasiness among the cows, which often withhold their milk in consequence of the bleating of the young animals. Hence it is obviously preferable to have the pens at such a distance from the feeding-house, that the cows cannot hear them.

* Annals of Agriculture, vol. xvi.

† Kaimes' "Gentleman Farmer," p. 56.

The construction of these buildings is very simple: Figure 4, Plate I, will convey a sufficiently clear idea of the most useful mode of erecting calf-pens: *a a* represent two spaces, one of which may serve as a door, the other as a window or a door, according to the option of the farmer, or as convenience may require: *b*, a passage situated between the respective pens: *c c c c c c c c*, &c. the various pens, exhibiting the different partitions which are retained in their respective positions by means of four pins inserted in holes at *d d d d* for that purpose; and *e e e e*, &c. are the vessels, or troughs, in which the young animals receive their milk.

A moderate, and rather cool temperature ought at all times to be kept in calf-pens, as well as the strictest cleanliness observed, and every attention paid to keep them dry and sweet.

§ 6. *The Piggery.*

When the profit arising from the rearing of swine is duly considered, and there is an opportunity of carrying on this branch of rural economy to any extent, it will be admitted that the establishment of a piggery demands even more attention than that of a dairy, combining as it does with more objects. A piggery, in the opinion of Mr. A. Young, must be in a circle, or it must fail in convenience; according to his idea, in the centre there should be the boiling or steaming house, with a granary for corn, meal, &c. Around this a range of cisterns ought to be disposed, in divisions, for receiving immediately from the copper, or steam apparatus, and also by tubes from the granary. Around these should run a path, then a fence or paling, in which are the troughs, with hanging lids, for supplying food directly from the cisterns, on one side, and for hogs feeding on the other; a range of yard next, and another of cow-sheds beyond, and last of all the receptacle for the dung. The potato stores, or *pyes*, should at one end point near to the entrance, and water must be raised to the coppers and cisterns at once by a pump; a trough, or other conveyance from the dairy to the cisterns, for milk, whey, &c. An arrangement like this, he conceives, would be very convenient, while the expense attending it would be inconsiderable; and great profit might

be derived, by setting apart a plot of natural or artificial grasses, into which the swine might be turned at pleasure. "Those," he adds, "who do not possess a convenient pig apparatus, can have little idea of the great use of it in making manure. This alone becomes an object, that would justify any good farmer in going to a certain expense, for attaining so profitable a part of what ought to be his farm-yard system.

By means of a yard constructed on this plan, Mr. Young fattened *eighty-eight* hogs in one spring, with the attendance of only one man; whereas three would have been inadequate to the task without such conveniences. The total expence of such a yard *now*, he thinks, would not be less than 150*l.*; and, if it were constructed according to the more correct idea, the cost would amount to 200*l.* or 250*l.*, but the *governing idea of position* should be followed in a *stie* of 20*l.*

This plan, however, is obviously calculated only for those farms where the fattening of swine is carried on upon an extensive scale. Where these animals are kept chiefly for domestic consumption, it will be sufficient if hog-sties be constructed with due regard to warmth and dryness, and divided into various partitions for the reception of swine, according to their age, varieties, &c. Each division should be between six and seven feet in width, of such a height as the beasts can conveniently enter, and with thatched or tiled shed roofs, as convenience or other circumstances may require. Each partition should be kept clean and well littered, and should be provided with a small space sufficiently capacious for holding the feeding-troughs, so that the swine may be conveniently fed without unnecessarily going in among them. The troughs may be so arranged, that offal, milk, &c. may be conveyed into them from the milk-house, or scalding-house, by means of pipes; and as these animals often thrust their feet into the troughs, and thus waste a considerable portion of food, this waste may be avoided by fixing sticks in a frame over the troughs, not unlike a rack; or a thin piece of plank may be nailed on the back part of the troughs, and so project as to allow their heads only to enter. This object may also be obtained, especially where swine are put up to fatten on dry food, by fixing a conical hopper (holding any given quantity) in a trough, with the broad end upwards; at the lower end should be an aperture for giving out the meat into the trough, or wooden receiver, where the animal may

eat it as it falls, without being capable of spoiling or wasting any portion of it. The top of the hopper ought to be about two feet and a half square, and provided with a strong lid, or fastening, so that the beasts cannot force it open. By adopting the expedient here suggested, a considerable advantage will be derived in fattening swine, viz. that though the animals will not perceptibly increase so fast as in the common mode of giving them food, yet their fat will be more firm, and of a better flavour, while it will be less liable to become rusty, qualities which must evidently contribute to the profit and reputation of the breeder.

Beside the various buildings above specified, it will also be proper to have stalls of similar construction with those already described, for the reception of sick or diseased cattle, which should be erected in some spot contiguous to the farm-offices, but at such a distance as to prevent the healthy beasts from being affected by the contagion.

§ 7. *Straw and Root Houses.*

The utility of these buildings, on those farms where the stacking of hay and straw is not adopted, is very great; as much time is saved in carrying hay and straw to cattle, perhaps from a considerable distance, and often with much waste. Where, however, stacks are employed, it will be advisable to convert the hay or straw house into a store-room for *roots*, and to supply it with a *root-steamer*, for the purpose of preparing such vegetables for the use of the cattle. This simple machine, in fact, is indispensably necessary on all farms where the feeding of cattle is conducted to any extent.



The apparatus here delineated consists of a brick or stone stove, about three feet in every direction, in which is fixed a pot or kettle, half a foot or eight inches deep, and eighteen or twenty inches in diameter. Over this boiler (when about half full of water) is placed a hogshead, or cask, the bottom of which is perforated with numerous holes, about an inch in diameter,

so that the steam may freely pass through the roots. In America, whence this contrivance was introduced into England, the top of the cask is usually left open, which might more advantageously be covered with a thick coarse cloth; or, which is much better, after the vessel is filled with the washed roots, it is closely clayed all round, and the head fastened down to confine the steam; and, if necessary, a short wooden plug may be inserted for the purpose of admitting air, and which may be removed at pleasure. When sufficiently steamed, the roots may be removed by means of a shovel, or by turning the cask over; and, thus prepared, they afford a more invigorating food to cattle than if they are given in a raw state. In small farm-houses, however, the family copper may advantageously be employed, by suspending over it a tub, the bottom of which is perforated with holes, so as to be lowered or elevated by a rope or pulley fastened to the ceiling. The tub may be of such a size, as to admit of fourteen inches to go into the copper; and to prevent it from sinking deeper, the part may be defined by a large hoop.*

§ 8. *Water.*

There is no article of greater importance to the health of animal life than a constant supply of water, which, being the only liquid cattle are accustomed to drink, ought, therefore, to be perfectly pure. Good water is indicated by limpidity and clearness, by continuing transparent notwithstanding the application of alkalis or other chemical tests, and by passing easily through the intestines. But its relative salubrity necessarily depends on the peculiar properties it possesses, and on the various mineral substances through which it passes. Thus, spring water, and that obtained from wells, are most wholesome when they have undergone a perfect filtration through sandy soils; and as the fluid usually consumed in farms is derived chiefly from these means, we propose, in the present section, to state a few of the most approved modes of preserving, or disposing of it to advantage.

* Another simple steam apparatus is figured and described in Sir John Sinclair's Work, vol. II. Appendix, p. 40—43.

Wells are the most frequent contrivances occurring on farms, for supplying water: their structure, indeed, is not immediately connected with the nature of the present work; but the following method of obtaining water, in almost every situation, is so simple, that we cannot but think its insertion will be of some advantage, particularly in those districts which are not remarkable for an abundant supply of that necessary fluid. This expedient was devised by M. Cadet de Vaux, an intelligent chemist of Paris, who directs the soil to be perforated with an augur, or borer: a cylindrical wooden pipe is then to be placed in the hole, and driven downward with a mallet, and the boring is to be continued, that the pipe may be forced down to a greater depth. As the borer becomes filled with earth, it should be drawn up and cleared; and, by adding fresh portions of pipe, the boring may be carried to a great extent under ground, so that water will thus, in most cases, be obtained. Wells made in this manner are superior to those constructed in the common mode, not only in point of cheapness, but also by affording a more certain and abundant supply, while no accident can happen to the workmen so employed. In case the water near the surface should not be of a good quality, the perforation may be continued to a greater depth, till a fluid of a purer kind can be obtained; and, where wells have already become tainted from any circumstance, or accident, if they be previously emptied, and the bottom perforated in a similar manner, so as to reach the lower sheet of water; this, being in the cylindrical tube, will rise in a purer state into the body of the pump fixed for this purpose.

In Plate I. Figure 5, is delineated an arrangement for distributing water in a farm-yard, invented by Mr. J. Cooper, an intelligent American farmer. His contrivance is excellent; for, by the disposition of his spouts and fences, he is enabled to water four different kinds of beasts at the same time, as is obvious on referring to the figure already cited.

But beside the convenience of having a supply of water at hand for domestic uses, as also for the consumption of the farm-yard, it is equally necessary to have, in the fields, one or more *drinking-ponds*, as the extent of the farm may require.

The situation best calculated for making ponds is at the bottom of a gentle declivity, (where that can be obtained), and in the corners where two or more fields meet together; by which

means a regular supply of water will not only be procured after rain has fallen, but also the cattle can be watered with less waste of time and of ground. Clayey soils are mostly selected for this purpose; but as these are liable to crack and become leaky from perforations by worms, and also from the evaporation of the water by intense heat, various expedients have been invented to prevent these inconveniences, and render ponds water-tight.

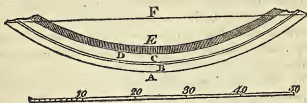
In making ponds, the pit ought first to be dug to a convenient depth: for those of 120 feet in circumference, or forty feet in diameter, five feet is a sufficient depth, which may be enlarged to seven, if the pond be 180 feet in circumference, or sixty feet in diameter; and if the situation will allow a reservoir to be constructed for the reception of the waste water, on the upper side of the main reservoirs, that portion of the water which is intended for the use of cattle will be preserved in a state of greater purity, while the sediment that will, from time to time, be collected in such reservoirs, may be easily drawn out thence, and converted into an excellent manure. Further, from these reservoirs an additional advantage might be derived, particularly if they lie in the vicinity of a town where there is a demand for *fish*, by stocking them with the last-mentioned animals, which would also afford an agreeable variety of food for domestic consumption. Lastly, the sides of the ponds should be carefully sloped to an angle of about forty or forty-five degrees, so as to admit the cattle with most convenience to them, and with little or no detriment to the bottom of the ponds.

Having thus stated a few preliminary circumstances necessary to be attended to in constructing ponds, we proceed to notice the most useful of the cements suggested for rendering them *perfectly retentive* of water, without requiring the aid of masonry-work.

While the cavity is digging, let a sufficient quantity of moist, brick clay be incorporated with one-fourth part of quicklime, (which should be slaked, the evening before it is used, with such a quantity of water as will make it of the consistence of cream cheese,) and the whole be formed into balls of two feet in diameter, or about six feet in circumference. After the pit is finished, and a proper supply of these balls is obtained, the labourer is to descend into the cavity, where a ball is

thrown to him; this must be thrown on the ground with all his strength, as nearly into the centre as possible. Successive masses, or balls, are placed in such a manner, that every one comes in contact with that which follows it, until the bottom and sides are completely lined. In case the whole of this operation cannot be finished in one day, it will be necessary to moisten the row last applied in the evening, in order that it may adhere to, and incorporate with such as remain to be laid on. Two or three days after this lining is completed, it must be beaten with a flat piece of wood, which labour should be continued with greater strength in proportion as the firmness increases; and the surface ought occasionally to be moistened, to prevent it from cracking, till the whole becomes a uniformly-solid mass. A coating of any cheap oil is then to be applied, on which a stratum of gravel, (about one inch in thickness,) should be laid before the pond is filled with water. Thus the coating will become remarkably firm and solid, and require no repairs, provided the pond be kept constantly full; as those parts of the work only, which are exposed to the air, are liable to be damaged by intense frost;* but this inconvenience, we think, may be avoided, if a scarcity of water be apprehended, by collecting and heaping large quantities of snow upon them, the first winter after the ponds are completed.

In the annexed engraving is delineated an outline of a pond for soils where there is a scarcity of water, of which description there are many in the county of York, where they were introduced about forty years since.



The line A represents a circular hole made in the ground, of such dimensions as circumstances may require; on this a stratum of clay, B, must be carefully beaten and trodden till it become a solid, compact mass, from four to six inches in depth.

* Journal de Physique, vol. i.

The line C describes a layer of quick-lime, about an inch, or an inch and a half in thickness, which should be also uniformly spread over the whole. D is a second stratum, or bed of clay, which ought likewise to be from four to six inches in depth, and be beaten and trodden down in a similar manner. The letter E designates stones or gravel, either of which minerals must be spread on the second bed of clay, to such a thickness as will prevent the pond from being *poached*, or injured by the feet of cattle, and consequently save the water from being discharged through the pores of the earth. F delineates the line of level both of the ground and of the water; and, when thus finished, the pond will be about five feet deep, and forty-five in diameter, the usual dimensions of these useful reservoirs in Yorkshire. The expense of constructing ponds, of the size above specified, is stated* to be from four to six pounds sterling, according to the distance whence the clay is carted; and reservoirs thus formed will remain unimpaired for many years, as the lime prevents worms from striking either upwards or downwards, and of course from damaging the clay.

§ 9. *The Dung-hill.*

The importance of dung, as a *manure*, for the various departments of agriculture, is too obvious to require any proof in support of this remark; but, as much of its utility depends on the manner in which it is managed in the farm-yard, we conceive it will not be altogether irrelevant here to give a few hints on the best mode of forming and tending the *dung-hill*.

For this purpose it is the usual practice to dig a pit, sufficiently deep to contain the stock of dung which the farm can produce, or the farmer procure. Into this cavity are thrown the waste fodder, dung, refuse of litter, weeds, and other substances, which lie there and rot till the manure is wanted. The following plan, however, which was suggested by the late Dr. Darwin, is certainly preferable, both for convenience, and for retaining the waste water, urine, &c. that would otherwise prevent the fermentation, and consequent putrefaction of straw. He proposes to form a heap of dung, or manure, on a gentle

* Annals of Agriculture, vol. vi.



declivity, with a bason at the bottom of it, for draining off superfluous moisture; and, if some earth, leaves, weeds, saw-dust, or other vegetable or animal refuse be thrown into this bason, it will facilitate the putrefaction of the substances it contains, while the draining from the dung-heap will not be dissipated. But, as the continual accession of liquor in the bason must, in the course of time, soften the earth which forms its bottom and sides, and thus much valuable compost be probably lost, it would be of essential benefit in preserving the liquor, if the bottom and sides of the pit were covered, first, with a hot mortar, consisting of lime and pounded gravel; after which a cement, prepared in the following manner, may be applied. Let equal parts of pounded brick, sand, and sifted stone-lime be thoroughly incorporated with hot lime-wash, and be spread on the surface as hot as possible; and to prevent the cement from cooling and becoming a solid mass, it will be advisable to make only a gallon, or such other quantity as may be laid on at one time, before the heat can evaporate.

In the county of Middlesex, the subsequent judicious mode is adopted in forming dung-hills, or *dung-meers*, as they are sometimes called. First, the scrapings of roads, the mud collected from ponds and ditches, and the *top mould* of gravel-pits, are spread in the most convenient places, as *bases* or bottoms for dung-hills. On these beds is carted all the manure produced on the farm, as well as what can be procured from the different inns occurring on the road, and also from the metropolis; together with the occasional addition of ashes, soap-boilers' waste, builders' rubbish, chalk, and other vegetable and animal recrement. In this state the heap continues, till within a month of the time for manuring the soil; the whole is then turned and mixed intimately together, and the larger pieces, or clods, are broken into smaller lumps, while those which may be too dry are thrown into the middle. By this treatment the whole mass is united more perfectly, and the fertilizing fluid that oozes from the dung during the fermentation which necessarily ensues, is effectually preserved, and greatly conduces to improve the land.*

The most proper situations for dung-hills are contiguous to the stables and ox-stalls, to which another may be added, near

* Middleton's Agricultural Report of the County of Middlesex, 8vo.



the house and piggery. They may be tended and augmented at odd times, when no other business, requiring particular attention, stands in the way. The *dung-meer* adjacent to the house, especially, may be easily composed of various rich and fertilizing ingredients besides dung. Thus the scrapings of the yard, after rain has fallen, may be advantageously thrown in; as also may some of the nearest earth, swamp mud, straw, weeds, the dung of fowls, soot, and ashes, shells, lime, and bones; the sweepings of the kitchen; oil dregs and any fatty matters; woollen rags; bloody water, in which meat or fish has been washed; greasy water; suds; ashes, even when the ley has been extracted from them; old useless brine; urine; and, in short, any animal or vegetable substance that does not contain too much acid; though even acids may be employed, if their properties be counteracted or overbalanced with abundance of alkaline substances.

In order to prevent the heaps from being too much torn or spread about by swine, or by the scratching of fowls, they may be usefully included in pens, made with wide boards; or, they may be walled to the height of two or three feet above the surface of the ground.

The dung heaps, contiguous to the barn or cow-houses, may be augmented with some of the nearest soil, mud, weeds, &c.; but, in every case, it will be proper that those ingredients predominate in each heap, which are best calculated to ameliorate the land on which it is to be laid. Hence it will be necessary to acquire a knowledge of the nature of the various manures; but, as this subject will be discussed in a subsequent chapter,* we shall conclude this article with observing, that if the waste liquor be thrown from time to time over the heap, it will contribute to increase the fertilizing properties of the dung; but, in wet seasons, it will be necessary to throw some slight shed over the heaps, as too great a degree of moisture will retard the fermentation. That process, however, will not take place so rapidly as it ought, unless the heaps are shovelled over once or twice, in the course of the summer; by such operations the various ingredients will be more intimately mixed and mellowed, and consequently the sooner fit for use; while the seeds of weeds therein will vegetate, and be destroyed.

* Chapter VI, Section III.

It is, further, of great importance to have either a pavement or good road all round the farm and dung-pit : as farmers suffer more than is commonly imagined, by having their carts and cattle straggling in farm-yards, through piles of straw, where this is neglected. It is also desirable to have two reservoirs for urine, where cattle are stall-fed in any number : as soon as one of these is full, it should remain in that state till it becomes putrid, previously to its being taken away, and the other may in the mean time be filling.*

§ 10. *The Kitchen-Garden.*

A good, well-calculated kitchen-garden is an important appendage to a farm, as it contributes greatly to diminish the expense of house-keeping ; at the same time that it enables the farmer to try experiments with new plants, on a small scale, and at comparatively little risk. The kitchen-garden ought to be situated either on the back or side of the house, so that manure may be conveniently carried thither, and a proper regard should be paid to proportion the paths, or walks, to the size of the ground, as much soil will otherwise be wasted, which might be more beneficially employed. It would far exceed the limits of this work, to enter more into the detail of a kitchen-garden, the arrangement and culture of which must, in all cases, be regulated by the wants or caprice of the owner or occupier ; let it therefore suffice to say, that particular care should be taken to *fence* it securely, so that neither swine nor poultry can enter, or injure its productions ; and that its corners be *round* instead of square, which will facilitate the turning round of carts, and thus prevent damage both to them and to cattle.

§ 11. *Pound.*

Pounds are of very frequent occurrence, for the reception of strayed or trespassing cattle ; but they are capable of being applied to more useful purposes, and, in fact, constitute a very great convenience to a farm. It will be advisable to arrange

* Sinclair, vol. i, p. 21.

them in a manner similar to that above stated for artificial ponds, viz. each pound being so placed as to serve four or five fields. In case of accidents to neat or other cattle, or when these are wanted for examination, pounds will be found very advantageous; as much loss of time is thus saved, which must otherwise be unavoidably incurred by driving them to the farm-yard.*

§ 12. *Farm-Cottages.*

It is a peculiar feature of the improved Husbandry of Scotland, and amply deserving of imitation by the more opulent landholders of England, that, in all the best-cultivated districts, cottages for the farm-servants are considered indispensable. In North Britain every hind or married ploughman has a separate house provided for him by his master, which the hind furnishes himself. The cost of these cottages varies from £. 30 to £. 50, according to size and the distance whence materials are brought. They are, or ought to be all insured, and lime-washed within at least once a year, to preserve the health of the inmates. The most convenient distance, at which to place them from the farmhouse, is from two to three hundred yards.† Of late years, the erecting of farm-cottages has been recommended and adopted in various parts of England, with equal improvement in comfort and moral character to the labourers by whose families they are occupied.

* Malcolm's "Compendium of Modern Husbandry," vol. i, p. 108.

† Sinclair, vol. i, p. 23, and vol. ii, pp. 242--244, where a plan is given of a Scottish cottage on a small scale.

CHAP. III.

ON THE FEEDING AND FATTENING OF CATTLE.

SECTION I.

Of the Pasture and other Food best calculated for Cows, as it respects their Milk.

As the nature of the grass, or other vegetables, has a very considerable influence both on the quality and on the quantity of milk which cows produce, the attention of the industrious farmer, will, of course, be directed to this point; for, as instances have occurred, where *six* milch kine, fed on some pastures, have yielded as much milk as *nine*, or even a *dozen* will afford on an inferior ground, it is obviously his interest to have his cows well fed and in good condition, rather than to keep up a particular number, without heeding whether they are properly supplied or not. Hence, as we have already observed, it will be proper to suit the milch cows to the nature and fertility of the soil; and on no account to purchase them from pastures superior to those destined for their reception.

The feeding of milch kine is divided into two branches, viz. *pasturing* and *house-feeding*.

In order to obtain an abundant supply of good milk, where the pasturing of cows is adopted, they ought uniformly to be well fed; for this purpose, grass growing spontaneously on good, sound meadow land is, in general, deemed the most proper food. Another requisite is, that the grass be plentifully produced, and of that quality which is relished by the cattle.

With such view, it has been found very beneficial to pasture cows on a field of grass, consisting of a mixture of Dutch clover and a little rye grass, or of equal parts of Dutch and white clover, intermixed with a small quantity of rye grass. In Scotland, a mixture of common goose-grass* and white clover is said to make one of the best kinds of pasture, of natural growth, of any in that country; and, it is asserted, that cows will milk pretty well when fed upon a pasture of this description, provided it be properly sheltered and situated low; because such pastures are warmer than those which are elevated much above the level of the sea.

Much attention, however, is necessary, in order to eradicate the crow-garlic, or garlic-hedge-mustard, (which is also known by the provincial names of Jack-by-the-hedge, or garlic-wormwood,) and similar vegetables; which, when eaten by cows, uniformly impart a rank flavour to their milk, and consequently to the butter which is made from it. And, as that fluid often becomes bitter, as well as liable to turn at the fall of the leaf, it will also be proper to prevent them, if possible, from eating decayed leaves, by collecting them. It is likewise worthy of note, that though the long, rank grass, growing in orchards or other places, in general feeds well, and produces a flush of milk, yet such milk will neither be so rich, nor carry so much cream in proportion, as the milk of those cows which are fed upon short, fine grass; nor, of course, will their butter be so good. Hence much attention and judgment must be directed to this point.

Further, the quality and quantity of milk is materially affected by driving them to a distance from one pasture to another; hence it will be proper, as we have already intimated, to have the cow sheds in as central a part of the farm as possible. Beside this circumstance, it is of essential importance to have pastures well sheltered and inclosed, as the produce of milch kine will be greatly improved, or irritated, according to the attention or disregard bestowed on this point; for, when cattle are confined within proper inclosures, they not only feed more leisurely, and without much labour or disturbance, but are also less liable to receive injury by being beaten, pelted with stones, or worried by dogs, which is inevitably the case where they

* The *galium aparine* of Linnæus; it is also called cleavers, or clivers.

wander into other fields, and consequently the owner must incur a considerable loss in the produce and quality of their milk.

With regard to the housing of milch kine during summer, the general practice is, where there are proper inclosures, to send them out in the evening, in order that they may lie out during the warm season. The advantages thence resulting are as follow: by breathing a purer atmosphere, they are less susceptible of the vicissitudes of heat and cold, while they are left to eat grass at liberty whether early or late; and it is asserted that they yield more and better milk than if they were confined in a house.

In the winter, however, milch kine are usually fed in houses on cut hay and straw; though, where the practice of keeping them in stalls does not prevail, it will be proper to have warm sheltered yards, furnished with open sheds, in which they can feed without exposure to the severities of the weather; a measure, of which the expense will be more than counterbalanced by the increased quantity of milk which they will yield.

In the management of milch kine, it is essential that they be, at all times, kept in high health and good condition; for, if they are suffered to fall in flesh during the winter, it will be impossible to expect an abundant supply of milk by bringing them into high condition in the summer. Hence, if cows are lean when calving, no subsequent management can bring them to yield, for that season, any thing like the quantity they would have furnished, in case they had been kept throughout the winter in good condition. During that inclement season, therefore, the most nutritious food should be provided for them, and the animals be kept in warm stables; for beasts will not eat so much when kept warm, as when they are shivering with cold;* and if they be curried in the same manner, and kept cleanly as horses in a stable, the happiest consequences will ensue, both in regard to the milk they yield, and the rapid improvement of the cows themselves;† but this treatment is, probably, not capable of being employed to advantage where numerous cows are kept. Pure water is a more essential article to cows, which, if well supplied with that necessary fluid, kept

* Dr. Anderson's "Recreations in Agriculture and Gardening," vol. iii.

† Baron d'Alton, in "Communications to the Board of Agriculture," vol. i.

clean, and laid dry, will produce milk more copiously, and afford a quantity of rich manure that will amply repay the trouble and attention thus bestowed on them. Dr. Anderson, indeed, (whose labours in behalf of useful science are too well known to require commendation,) has stated, that he knew a man who attained to great opulence by attending to these circumstances, and particularly to the important one of having a continued supply of the purest water that could be procured for his milch kine; nor would he, on any account, permit a single animal to set a foot into it, or suffer it to be tainted even by the breath of the beasts.

It has already been intimated, that the best summer food for cows is good grass, spontaneously growing on sound meadows, as their winter food usually is hay. When, however, other green food cannot be obtained, the tops or tenderest twigs of the common furze, (gorse or whins, as the plant is variously called,) may be bruised and given to them; in fact, this vegetable is, in the opinion of Dr. A. greatly superior to common fodder, as it increases their milk without imparting any unpleasant flavour to it. They are cut at Michaelmas, will continue till Christmas, and be fit for use till March. Other excellent additions to hay for winter food are *parsnips* and *carrots*, which roots not only render the milk richer, but also communicate to the butter made from such milk a fine saffron colour, equal to that produced by cows feeding on the most luxuriant grasses:—the *mangel-wurzel*, or root of scarcity, which, on the continent, is preferred to every other vegetable for feeding cattle in general:—*potatoes*,* on which cows will thrive well; so that with one bushel of these roots, together with a little soft meadow-hay, they will yield as large a quantity of sweet milk, or butter, as they usually afford when fed on the finest pastures:—*cabbages* are likewise of eminent service in this respect, but they require to be given with a good portion of fine hay:—to these may be added *burnet*, the utility of which is too well known to require any particular detail here:—*fog*, or grass reserved for winter use, which is cut and carried to the animals:—*spurry*, a useful vegetable employed to a great extent, for fodder, on the continent, where it is preferred even

* Much benefit it is ascertained, may be derived by steaming the various roots above mentioned; for a simple apparatus, which is well calculated for this purpose, *vide ante*, Chapter II. Section II. § 7, p. 106.

to grain :—pulverized *oil-cake*, *turnips*, *tares*, *rouen*, and similar succulent food. By the judicious use of these various articles, together with a due admixture of dry food, considerable nutriment is thrown into the system, while the regular secretions will be excited, and the quality of the milk very materially improved.

The following mode of feeding milch kine is practised, to a great extent, in the county of Middlesex, from which the inhabitants of London chiefly derive their milk. During the night the cows are confined in stalls, and about three o'clock in the morning each has a half-bushel basket full of grains given to her; when the operation of milking is finished, each receives twice that quantity of turnips, and shortly after one truss of the finest, softest, earliest made, and greenest meadow-hay is divided among ten cows. These various feedings are usually made before eight o'clock in the morning, when the animals are turned into the cow-yard. Four hours after, they are again tied up to their stalls, and supplied with the same allowance of grains as they had received in the morning; on the conclusion of the afternoon milking, (which generally continues till near three o'clock,) they are served with a similar quantity of turnips; and in the course of another hour, with a like allotment of hay. This method of feeding usually continues throughout the turnip season, that is, from September to May; during the remaining months they are fed with grains, tares, cabbages, and the proportion of rouen, or second-cut meadow-hay, already mentioned; and are fed with equal regularity until they are turned out to grass, when they pass the whole of the night in the field; and, even, during this season, they are often fed with grains, with which some cow-keepers mix common salt, with a view to preserve them longer in a sweet state. But this practice has much declined, as the proprietors, who tried the experiment, did not meet with an adequate return for their labour and expense;* though it has been asserted, that

* Middleton's "Agricultural Report for the County of Middlesex," &c. This intelligent reporter farther states, that brewers' grains may be preserved, in a sound state, from March till Summer, when brewing is discontinued, by tightly treading them down in pits below the surface of the ground, and covering them with a layer of earth, in order to exclude the air and prevent fermentation. Such vats, or pits, now are, or lately were, to be seen at Rhodes's, the cow-keeper's, near Kingsland Road; and also at Islington.

the mixing of salt with the food of cows (which will eat it with great avidity) both increases the quantity and improves the quality of the milk, while it contributes to promote the health of milch kine.

In the course of the preceding statements, the *stall-feeding* or *house-feeding*, of cows during the winter has been mentioned; and, from the remarks of Baron d'Alton,* it appears that this method of feeding may be adopted throughout the year with greater profit than can be obtained from pasturing. The benefits capable of being derived from *stall-feeding* are, indeed, very great; but as this mode is equally applicable to the feeding and fattening of neat cattle in general, (which will be discussed in a subsequent page,) the reader is referred to the following section, where its advantages are fully detailed. At present, therefore, we shall only remark, that independently of the great additional supply of rich manure thus attainable, a considerable saving will be made in the trouble of attending cows as well as in the consumption, or waste, of food by the common practice; particularly in those situations where lucern, sainfoin, clover, and cichory can be abundantly commanded; which succulent vegetables, however, will require to be mingled with hay, straw, or similar dry food, in order to promote the regular secretions of the animals. Baron A. indeed says, that cows must be early trained to the confinement of stall-feeding, otherwise they do not thrive; but we understand, from an intelligent correspondent in Philadelphia, that this opinion does not hold in every respect; for he was informed by a friend, that while the British troops occupied Philadelphia, during the American contest, *he confined a cow upwards of twelve months in his stable*; and that, by feeding her on good hay, and occasional messes of short, wet feed, with the usual attention to cleanliness, he preserved the animal in health, and obtained an abundant supply of milk. It must, however, be admitted, that all cows may not thrive equally well, if penned up; but, as the advantages of soiling and stall-feeding are so great, there can be no difficulty in adopting it and executing it where it is intended to keep calves of a particular breed; they may be easily reconciled to the confinement.†

* Communications to the Board of Agriculture, vol. i.

† The object is, of this section, chiefly to point out the best mode of applying vegetables to the feeding of cows; as the peculiar advantages of

Sea-weed has of late-years been given to cows by way of *condiment*. Mr. Macallum, a cow-keeper of Edinburgh, gives his milch cows sea-weed in lieu of turnips, when these roots are scarce and dear, particularly in the months of February, March, and April. He uses the *fucus digitatus*, or digitated sea-urack, and the *fucus serratus*, or serrated sea-urack, but not the *fucus vesiculosus*, or common sea-weed, lest it should fill the animals with *wind*. Mr. M. begins by parboiling the sea-weed, and giving the cows some of the liquor : when they drink the water, they are offered some of the parboiled weed itself : and, when they eat it parboiled, it is gradually given to them *raw*. He gives each cow, once or twice a day, as much as a person can neatly carry at once between his two hands. These marine plants operate as a gentle laxative, and Mr. M. thinks that their use promotes the health of his cows, and consequently increases the quantity of milk they yield.* This is an interesting fact, well deserving the notice of the attentive farmer on or near the sea-coast, particularly in the vicinity of the numerous large and popular places of resort for sea-bathing.

Steaming food may also be given to milch cows with great advantage. For this important fact in rural economy, the grazier is indebted to the ingenious and persevering experiments of J. C. Curwen, Esq. M. P., whose attention to the comforts of his tenants, and judicious zeal for the improvement of agriculture, are too well known to require any eulogy. In prosecution of a system which he had long practised, of giving cooked food to animals, Mr. C. turned his attention to the cheapest mode of supplying milch cows with it ; and, in a communication to the Society for the encouragement of Arts, &c. (which was honoured with their lesser gold medal,) he states his belief, that he has at length been completely successful. He uses a steam-boiler of 100 gallons contents,† on each side of which are fixed three boxes, containing 11 stone each of chaff (the husks of corn,) which, by being steamed, gains more than *one-third* of its original weight. The steam is conveyed by various stop-cocks

each, together with their culture, will be specified in a future chapter, it did not appear necessary to enlarge particularly on that subject in the present section. *Vide infra*, Chapter VII.

* Sinclair, vol. ii. Appendix 29.

† An Engraving of it is given in the 30th volume of the Society's Transactions, p. 68.

into the lower part of the boxes; and thus two or three boxes may be steamed at the same time; the quantity of fuel required is about 2lbs. for each stone of chaff.

In giving the steamed chaff to the cattle, 2lbs. of oil-cake are mixed with one stone of chaff; and the milch cows and oxen are fed with it morning and evening, having an allowance of one stone at each time. On being taken from the steamer, the food is put into wooden boxes, which are mounted on wheels, to be drawn to the place where it is intended to be used; and the chaff requires to stand some time before it is fit for use. Mr. Curwen estimates the daily cost of food for each cow as follows:

	<i>Pence.</i>
Chaff, two stone, steaming, &c. - -	1
Oil-cake, four pounds - - - -	4
Eight stone of turnips, 14lbs. per stone. 4	
Wheat straw - - - - -	1
Total - - -	10

The average of milk on a stock of thirty-six milch cows, was nearly 13 wine quarts, for 320 days; which was sold at 2d per wine quart. The calves brought from £.2 to £.5 for rearing. The produce is stated by Mr. Curwen to be nearly half clear profit, estimating the manure as equal to the calves. The cows were never suffered to be turned out; and to prevent their being lame, their hoofs were properly pared, and they stood with their fore-feet on clay. One great advantage attending this method was, that most, if not all the milch cows were in such a condition that, with a few weeks feeding after they were dry, they became fit for the shambles, with very little loss from the first cost. As a substitute for chaff and oil-cake, Mr. C. recommends cut hay; which, when steamed, would make a much superior food, and he entertains no doubt would greatly augment the milk, as well as benefit the health and condition of the animals. The strictest attention is necessary, to see the cows always kept clean, and never to suffer the least heat to appear upon their skins without an immediate application of black soap and water. They are also to be carded or curried; and care should be taken to keep them in a regular degree of temperature, as any considerable change affects their

milking. Mr. Curwen gives cooked food from October to June, nearly eight months out of twelve, and his plan of treatment has been adopted by several farmers in different parts of the kingdom, with the most complete success.

SECTION II.

Of the feeding and fattening of neat Cattle; including a comparative View of the Advantages resulting from Grazing, Soiling, and Stall-feeding.

THE feeding and fattening of cattle, whether for labour or for sale, is the most important in the whole economy of the grass farm: hence the farmer should previously consider the *nature* and *fertility* of his *pastures*, and the extent and quality of his other resources; and, according to these, he ought to regulate his system of *grazing*, *soiling*, or *stall-feeding*; selecting, in the first instance, those beasts only which evince the most *thriving disposition to fatten with the least consumption of food*, and depasturing them upon such lands as are best calculated for the respective breeds; and especially taking care, (as already intimated,) not to bring cattle from rich to inferior soils, but, wherever it is practicable to choose them from lands of nearly the same quality as those destined for their reception; beside which precautions, it will be necessary, in all situations which are not provided with wholesome water, to avoid selecting cattle from those districts where that fluid abounds in a state of purity.

The introductory view of breeds prefixed to this work, will probably supply some hints for enabling the farmer to decide what sort of stock is calculated for peculiar situations; in addition to those remarks, we would observe, generally, from the practice of the most eminent graziers, that the larger beasts are preferable for the more luxuriant pastures; while, in such as are less rich, small stock answer best. Thus it is remarked by an able correspondent, in Mr. Young's "Annals of Agriculture," (vol. xxxii.) that a grazier, who has fine and fertile pastures, may select his beasts as large as he can find them; provided they are of the right sort and shape. He, however, recommends *shape* to be always preferred to *size*, as this will pay them

better; and, it is requisite, that those who are upon indifferent grass take care to proportion the *size* of their beasts to the *goodness* of their pasture; for it is preferable to have cattle rather too small than too large, because there are numerous tracts of ground which will be profitable for grazing such cattle, which are not capable of supporting large breeds. Hence we find, that in the rich grazing counties of Lincolnshire, Sussex, &c. large breeds are chosen, with a mixture (in the former county) of Scotch and other cattle, bred in the vicinity. In the counties of Norfolk and Suffolk, the kiloes and galloways are fattened preferably to any other breeds, on account of their superior kindness, and the excellence of their flesh, which uniformly procure a ready sale in the London markets. Next to these, in the esteem of salesmen, is the dark red variety of the Devonshire sort, which chiefly prevails in the counties of Leicester, Oxford, Somerset, and Warwick; to these may be added the Glamorgan, Hereford, and Suffolk polled breeds of cattle, all of which are eminently profitable in particular situations. Of late years, however, many eminent graziers have given a decided preference to smaller cattle; and the following remarks of an eminent and enlightened breeder,* being founded on fifteen years experience, strikingly corroborate the propriety of that preference. "The smaller animal (generally) has a more natural disposition to fatten, and requires (proportionably to the larger animal) less food to make it fat; consequently, the greater quantity of meat for consumption can be made per acre. In stall-feeding, whatever may be the food, the smaller animal pays most for that food. In dry lands, the smaller animal is always sufficiently heavy for treading. In wet lands less injurious. As to milk, the smaller animal produces more goods for the goods she consumes, than the greater animal." But, in order to carry on the grazing of cattle with effect, it is necessary that the grazier form a complete plan, or system, and proceed regularly therein, deviating from it in those instances only which obviously tend to improve his course; and ultimately to increase his profits.

With regard to the species of cattle best calculated for grazing, spayed heifers and oxen† are certainly superior to any

* C. G. Grey, Esq. in the tenth volume of Bath Papers, p. 262.

† Neat cattle are known by various appellations according to their age and sex; which, as such terms may probably often appear in the course of

other stock; the former, indeed, are of less frequent occurrence, though they fatten with more expedition. But oxen are more commonly and justly preferred, as they may not only be moderately worked for a series of years, but also when very old, their flesh makes excellent beef.* Wintering heifers in calf, in some grazing districts termed *in-calvers*, may also be advantageously fattened, if attention be paid to selection, and the beasts are well fed during the winter, on rich succulent crops; they are occasionally sold for small sums at the autumnal or Michaelmas fairs, and may be disposed of in the succeeding spring, with the calves running by their side, to considerable profit. *Free martins*, or barren cows, have also been tried for the purpose of fattening, but they rarely succeed; this is also the case with old cows, and such as are become dry, which may, in a few instances, prove a source of profit; but as they are for the most part hazardous, and much inferior to young or middle-aged stock, (which are always to be selected, if possible, from their *kindliness to fatten*,) it will be proper that such cows take the bull before they are turned into the pastures; and they be constantly ready for sale, at least three months before the time of gestation expires.

It has been intimated, that young, middle, or small-sized cattle are preferable for the purpose of grazing; they are certainly best calculated for the gradual mode of grazing, the duration of which varies from a year and half to two years; and, by the manure they afford, as well as the enlarged price they fetch when sold, they amply repay the expense of their keep. In stocking lands with cattle, the proportion of beasts to be introduced must depend upon the fertility of the soil, as well as the present work, it may not be amiss here to state. "Thus the bull, while sucking, is called a *bull-calf*; when turned of a year old, he is a *stirk*, or *yearling-bull*; after that, a *two*, *three*, *four*, or *five years old bull*, until *six*, after which he is deemed aged. When castrated, he is termed, for the first year, an *ox*, or *stot-calf*; then a *stirk*, *stot*, or *yearling*; for the two following years he is a *two* or *three years old steer*; and, at *four*, he receives the name of *bullock*, (which has of late years been extended to denote *fattening cattle* in general.) The name of the female neat cattle is, for the first year, *cow-calf*; then a *yearling quey*, *heifer*, or *twinter*; the next year, a *three year old quey*, or *heifer*; at four, a *cow*, which name continues; if spayed, she is termed a *spayed*, or *cut heifer*; or *spayed*, or *cut quey*, in the northern parts of this island."—Culley on Live Stock, p. 17, 18. 3d Edition.

* For a comparative view of the excellence and utility of oxen, *vide supra*, Chapter I. Section V. p. 55—68.

upon local custom, and other circumstances. In the counties of Somerset and Devon, one acre, or one acre and a half of the richer kinds of land, are allotted to one ox, to which a sheep is sometimes added: but fertile as those districts are, they are surpassed by the richer grounds of Lincolnshire, the best of which will support one ox and fourteen large sheep on two acres during the whole summer, and five sheep on a similar space of land in the winter, or *sixteen* sheep on one *acre* throughout the summer. And instances have occurred, in which *one hundred and ten* Lincolnshire sheep, and *fifteen* large bullocks of the same breed, have been fattened on *fifteen* acres, the last-mentioned animals having been put to spring grass out of the straw-yard, and fattened to the enormous weight of 1,130 pounds by the ensuing Michaelmas.

In order to graze cattle to advantage it ought to be a fundamental principle so to stock them that they may feed without restraint; beside which, as often as opportunity or other circumstances will allow, it will be profitable to change them from one pasture to another. By this expedient, as cattle delight in variety, they will cull the uppermost or choicest part of the grass, and by filling themselves quickly, as well as by lying down much, they will rapidly advance towards a proper state of fatness; while the grass, which is thus left, may be fed off with labouring cattle, and lastly with sheep. Hence it will be advisable to have several inclosures, well fenced and sheltered, and abundantly supplied with wholesome water. Respecting the best size for such inclosures, there is a difference of opinion; from ten to fifteen or twenty acres, perhaps, is the most appropriate; though, if any be of a greater extent than this, they may be divided by a strong, but temporary fence for this purpose. Their size, however, should be various, as small ones are preferable in winter, and larger ones during the summer. Thus the greatest and strongest cattle will be separated from the weaker ones; for, if cattle of various sizes are indiscriminately mingled together, the more powerful beasts will master the others, driving them from place to place, and trampling upon or wasting more food than they can eat.

To prevent these inconveniences, some intelligent graziers recommend the following method of feeding and fattening cattle. Suppose there are four inclosures, each consisting of from six to ten acres each, one of such inclosures ought to be

kept perfectly free from stock till the grass is in its full growth, when the prime, or fattening cattle should be put into it, that they may get the best food; the second best should then follow, and the young stock after all, making the whole feed over the four inclosures in the following succession :

First inclosure. Free from stock, till ready for the best cattle.

Second inclosure. For the reception of the best cattle, till sent to No. 1.

Third inclosure. For the second best cattle, till sent to No. 2.

Fourth inclosure. For the young cattle, till sent to No. 3.

Thus the fourth inclosure is kept free from stock till the grass is got up, and it is ready for the prime cattle.

Further: it will be of service to erect *rubbing-posts* in different parts of the various inclosures, where stock are feeding. This practice originated in the county of Norfolk, whence it deserves to be more generally known and adopted, as such posts keep the cattle from the fences, and, as Mr. Marshall observes, "furnish them, no doubt, with an agreeable, and perhaps a salutary amusement." He also remarks, that some Norfolk farmers draw the crown of a tree, with the lower part of the boughs left on it, into the middle of the close; this is less trouble than putting down a post, and is easily rolled out of the way of the plough, and seems to be still more agreeable to the cattle.*

Before we proceed to discuss the other branches connected with the grazing of cattle, we trust it will not be altogether irrelevant to state a few particulars concerning the peculiar practice, or management of some of the most eminent graziers.

Thus some farmers purchase *heifers* in the month of March or April, these are kept throughout the summer till October or November, when they are disposed of. In peculiar situations, this method is capable of being adopted with profit; but it is inferior, in point of advantage, to the practice of those graziers who buy in lean cattle in the month of May, and turn them in upon the meadows and pastures as early as possible. Here the

* Marshall's "Rural Economy of Norfolk," vol. ii, p. 115, 2nd Edit.

beasts become completely fat on the *grass-feed* towards the close of October, or the commencement of November, or even later in the year, according to their *kindliness* of disposition in taking on fat. This mode is very beneficial, particularly with small cattle, as these can be turned into the less fertile lands, which would not afford an adequate supply of food to the larger sorts of beasts. In the county of Middlesex, the method just mentioned is applied with uncommon success, on *luxuriant hay-farms*. The graziers in that county purchase small cattle, which are in pretty good condition, as early in the autumnal quarter as the *rouen latter-math*, or after-grass, is ready; into this the beasts are turned, and are sold to considerable advantage about the end of October, or early in the ensuing month of November.

There is another mode practised in some grazing districts, where the lean stock are purchased at various periods and of different sizes, so that they may be sent to market in April or May, when such beasts are generally sold for considerable sums. According to the plan of these graziers, the cattle are sometimes kept throughout *two* winters, during the first of which they are not at *full keep*, but in the following summer they are turned into good grass, and are fattened off in the second winter with the best and most forcing food the farmer possesses. The more common system, however, consists in buying small cattle as early in the spring as the grass affords a good bite, when they are allowed one summer's grass, and are stall-fattened in the ensuing winter; but these two methods are too expensive to be generally adopted, and, in fact, can only be practised *with effect* on the richest grass lands.

With regard to the management of pasture grounds, it may be observed, that those which are *laid*, or allowed to *rest* at Candlemas, may be grazed in the following May; such as are laid in May, may be grazed at Midsummer; those to which rest is given at that season, may be grazed at Lammas; while such as are laid at Lammas may be grazed in October, and generally throughout the succeeding winter.

In the grazing of cattle, a variety of circumstances will claim the farmer's attention, in order to conduct his business with regularity or with profit. Hence he ought to take especial care not to turn his stock out into the pastures in the spring, before there is a *full bite*, or the grass has obtained a sufficient degree

of length and maturity: for neat cattle, whose tongues chiefly enable them to collect the food, neither can nor will bite near the ground, unless they are compelled by extreme hunger, in which case, it is obvious they cannot enjoy their feed, and consequently cannot thrive in proportion.

Further: where beasts are turned into fields, consisting either of clover entirely, or of a mixture of natural and artificial grasses, great circumspection is required, to see that they do not eat so eagerly, or to such excess, as to become *blown* or *hoven*, an affection to which cows are more peculiarly liable than any other neat cattle. That disorder, however, may be prevented either by feeding the animals so as to gratify the cravings of appetite before they are turned into the pasture, or by constantly moving them about the field for a few hours after they have been turned in, that the first *ball* at least may sink into their maw before the next be deposited. Should they, notwithstanding, be attacked with that dangerous swelling, they may be relieved by adopting the remedies pointed out, *infra*, Chapter IV. Section I.

Grass usually attains its acmé of maturity and luxuriance about Midsummer; and from that time to Lammas it possesses a peculiar sweetness, so that stock may be allowed, during the intervening period, to bite somewhat nearer to the ground. It will, however, be necessary to remove fattening cattle, (as already intimated), from time to time, into fresh grounds; so that by taking the uppermost and choicest part of the grass, they may feed both expeditiously and thoroughly. The grass left behind them may be fed off first with labouring cattle, and afterwards with sheep. This last-mentioned point cannot be too minutely regarded; for, if cattle be in want, they will lose more flesh in one day than they can possibly gain, or recover, in three. Hence those meadows, or pastures, (particularly such as lie in fenny or other situations, which retain moisture for a long time,) ought to be fed off as early as possible, lest sudden or long-continued rains descend, which will not only render the juices of the grass thin and watery, and ultimately putrescent, but which will also materially affect the health and constitution of the animals, and not unfrequently occasions that consumptive (and often epidemic) disease, the *rot*. To prevent the losses consequent on such accidents, it will therefore be indispensably necessary, daily and attentively to inspect the grazing

stock; and if any beasts appear to be affected by eating wet grass, they should be immediately conducted into dry shelters, and fed with hay or straw; though, if no shelter be conveniently at hand, they must be driven to the driest spot, and there supplied with *sweet* cut grass and *dry* fodder.

The *hard* or *light* stocking of pasture ground is a point on which many experienced graziers are by no means agreed. By some it is contended, that pastures ought to be stocked very lightly; alledging, that although much of the produce is thus allowed to run to seed, which the cattle will not eat, and which is consequently trodden under foot, where it is rotted by rain, and thus wasted; yet experience, say the advocates for *light* stocking, evinces that a greater profit will, upon the whole, be thence derived than by any other practice, on account of the superior thriving of the animals.

By others, on the contrary, it is maintained, that the practice of light stocking is highly to be condemned; because it not only tends gradually to diminish its produce, but also to encourage the growth of coarse and unprofitable grasses, which materially deteriorate the pastures; and that the *hard* stocking of grass lands, particularly those of a rich quality, is an indispensable requisite of good management. It must be confessed, that the superior fertility of the *hard-stocked* Lincolnshire pastures tends greatly to corroborate these assertions; but it is recommended by a third party, (whose opinion, perhaps, approximates more nearly to the truth,) that mixed stock should be always kept on the same field; and, if the consumption of the foul grass, produced by the dung of the animals, were the only article to be adverted to, it might, doubtless, be so managed as to correct this evil; though it must be admitted, that there is such a variety of circumstances to be attended to, that even this expedient will not remedy them all.

In every field, numerous plants spontaneously spring up, some of which are disliked by one class of animals, while they are eaten by others; and some of which plants, though eaten with avidity at a particular period of their growth, are entirely rejected by the same beasts at another period of their age. Hence it becomes necessary, not only to have a great variety of cattle in the same pasture, but also a very particular attention is required to augment or diminish the proportions of some of these classes of animals at certain periods of the year; other-

wise some part of the produce will run to waste, unless indeed it be *hard stocked* to such a degree as to retard their thriving.

Where, however, a great variety of animals is allowed to go at large in the same pasture, they rarely feed with that tranquillity which is necessary to ensure thriving; it frequently happens, that one class or sort of beasts wishes to feed or to play, while others are inclined to rest. Thus they mutually teaze and disturb each other; and this inconvenience is materially augmented, if any sort of *penning*, or confinement, be attempted. Hence it is obvious, that the practice of inter-mixing various kinds of live stock is productive of evils, which are, in many instances, greater than those resulting from the waste of food intended to be prevented by this practice. There is, indeed, no doubt but that by *hard stocking*, the grass will be kept short, and will consequently be more palatable in general to the animals that eat it, than if it were allowed to grow to a great length; and that even unpleasant patches may thus be consumed; but as animals, which are to be fattened, must not only have *sweet* food, but also an *abundant bite* at all times, in order to bring them forward in a kindly manner, it appears scarcely possible to unite both these advantages in such practice.

Independently of remedying the inconveniences above specified, a variety of circumstances concur to prove, that the practice of *soiling*, or feeding cattle during the summer with different green and succulent vegetables, which are cut and carried to them; and of *stall-feeding* them in the winter season with dry fodder, in conjunction with various nutritive roots, will in general be highly economical. The former of these modes, in particular, has been but little used till within a few years, and has not been treated with that attention which its importance deserves: hence, we trust, it will neither be inconsistent with the nature of the present work, nor altogether uninteresting to those who are sedulously aiming at the improvement of their lands, if we consider the subjects of soiling and stall-feeding in the following points of view.

I. By introducing the practice of soiling, a *very considerable saving of land* will be effected; one acre of cut grass soiled, being equal to three acres used as pasture; and one acre of cut clover being equal to two acres pastured, even of the same field, and sown with the same grass, the clover not being

trampled upon, and growing so much faster than if it were often corroded with the teeth of an animal. And it has been affirmed that *sixteen* acres of clover and tares will feed as many horses and cattle as *thirty-six* acres of the same kind of grass would do, if used in pasturage.*

II. There is also a very *considerable saving in the quantity of food consumed*, as well as a greater variety of plants eaten, and consequently prevented from running to waste: for when animals are suffered to go upon the field, many plants are necessarily trodden under foot and bruised, or partly buried in the earth; in which state they are greatly disrelished by cattle, and are suffered to run to waste; a circumstance which never could occur, if the practice of cutting were adopted.

And if the consumption of plants be the object principally regarded, it is obvious that the benefits thence to be derived will be very great; for experience has clearly proved, that cattle will eat with avidity many plants, *if cut and given to them in the house*, which they never would touch while growing in the field: such are the dock, cow-parsley, thistles, nettles, and numerous other plants. We confess, we know not to what circumstance this can be attributed; but the fact is, that the animals will eat them without exhibiting any marks of dislike or reluctance, even when they are not pressed by hunger; and they often greedily devour these plants as soon as they are brought in from the field, and before they can have possibly had time to become hungry. There are even vegetables which, in a green state, are poisons to cattle; but which, when cut and dried into hay or fodder, may not only be given with impunity, but are also eaten with avidity. Such, for instance, is the *water-crow-foot*,† with which (according to the statement of Dr. Pulteney),‡ the cottagers in the vicinity of Ringwood, on the banks of the Avon, almost entirely support their cattle; and so eagerly do these animals consume it, that they deem it unsafe to allow them more than a certain quantity. Cows, indeed, are asserted to be so peculiarly fond of that vegetable, (which keeps them in good milking condition,) that, exclusive of the scanty pittance they obtained on an adjacent heath, *five*

* Sinclair, vol. ii, p. 19.

† The *Ranunculus aquatilis* of Linnæus.

‡ "Transactions of the Linnæan Society," vol. v.

cows and one horse did not consume more than half a ton of hay in the course of a year. Thus, it is evident that fewer plants will either be rejected or suffered to waste.

Farther, it is well known that many of our best and finest grasses, which, when young, form a most palatable food to cattle, are, if once suffered to get into ear, so much disliked by them, that the beasts will never taste them unless compelled by extreme hunger. And as, in most pastures, many of these grasses get into ear from various causes, their produce is, of course, inevitably lost to the grazier; whereas, if cut down by the scythe in proper time, not one plant will be suffered to get into that nauseating state, and consequently no waste can be sustained from this cause.

In addition to the preceding observations, it may be remarked, that those few plants which are totally disregarded by one class of animals, so as to be rejected by them, even in the house, will not, on that account, become less acceptable to others, but greatly the reverse. Thus grass, or other food, that has been *blown* or *breathed upon* by any animal for a considerable time, becomes unpleasant to other beasts of the same species, but not so to stock of another class or variety; for them, indeed, it appears to acquire a higher relish. Even greater defilement by one animal seems to render food more acceptable to others; for straw, which in a clean state has been refused by cattle, if employed as a litter for horses, acquires for the former such a relish, that they seek for it with avidity. Hence it happens, that the sweepings of the stalls from one animal supply a pleasing repast for those of another kind, which can be easily removed from one to the other, if the plants are consumed in the house, but which must otherwise have been lost in the field. And this peculiarity may, as we shall shortly have occasion to show, be employed to answer another useful purpose.

III. With regard to the influence produced by soiling and stall-feeding on the *health and comfort of cattle*, the balance, we conceive, will be clearly in favour of the cutting system, when compared with that of pasturing. Thus, they are not liable to be blown or hoven, or to be staked or otherwise injured by breaking fences: and it is well known that when animals are exposed to the sun, in the open air, they are not only greatly incommoded on many occasions by the heat, but are also annoyed by swarms of flies, gnats, and hornets, which, as well

as the terrible *gad-fly*,* drives them into a state of perturbation little short of madness, which must obviously tend to impede their thriving. At other times they are hurt by chilling blasts, or drenched by cheerless rains, which (especially in humid situations) not only retards their feeding, but also occasions that consumptive epidemic, the *rot*. Under proper management, in well-constructed stalls, all these evils would be alike removed, and they would be kept in a uniform state of coolness, tranquillity, and ease, so as to make the same quantity of food go farther in nourishing them than it otherwise could have done. The cattle will also, by such treatment, be prevented from licking up worms, snails, slugs, and other noxious creatures among their food: which is frequently the case by pasturing, when they feed at those times of the day or night in which these vermin are in motion. This inconvenience would be entirely avoided, by cutting the grass at such times as none of those animals are visible; beside which, numerous lingering diseases may thus be often prevented, that always impede the thriving of the cattle, and not unfrequently terminate the existence of the beast. Lastly, by judiciously mingling green and succulent vegetables with dry and nourishing food, as circumstances may require it, in any given proportions; and by varying the different articles so as to provoke an appetite, not only the health, but also the thriving of the creatures will be greatly augmented beyond what they could have been by any other mode of treatment.

IV. The proportional increase of manure obtained by soiling and stall-feeding, further evinces their superiority over pasturing. *Manure* is the life and soul of husbandry; and, if it is chiefly to be attended to, there can be no comparison between the two modes of consumption, especially with regard to the manure obtained by soiling live stock, during summer, with green food; for, in consequence of the increased discharges of urine during that season, the litter, of whatever substance it may consist, is speedily converted into dung. And there can be no doubt, but that the quantity of manure made during the summer may, by constructing proper reservoirs for the reception of the stale, and by throwing this at leisure times over the litter, (as intimated in a former page), be made to equal, if not

* The *Æstrus bovis* of Linnæus, sometimes called the *breeze*.

exceed, the produce and quality of the dung accumulated during the winter. A great augmentation may also be made to the dung, by daily throwing some hot unslaked lime under the bedding and tails of stall-fed cattle, for the purpose of absorbing the urine, increasing the fermentation, and retaining the oleaginous parts of the dung. These circumstances, indeed, are so greatly in favour of soiling and stall-feeding, that we conceive any farther proofs, in confirmation of our remarks, altogether unnecessary.

V. With regard to the *quantity of herbage* afforded from the same field, under the *cutting* or *grazing* systems, the balance will be found equally in favour of the former. All animals, it is well known, delight more to feed on the young and fresh shoots of grass than on such as are older. Hence it invariably happens, that those patches in pastures which happen to have been once eaten bare, in the beginning of the season, are kept very short throughout the remainder of that season, by the animals preferring them to other parts of the field where the grass is longer; so that the latter are often suffered to continue in a great measure untouched throughout the season. Another circumstance, however, which is not very generally known, is, that grass—even the leafy parts of it—when it has attained a certain length, becomes stationary; and, notwithstanding it will retain its verdure in that state for some months, yet it would have continued in a constant state of progress, advancing with a rapidity, in a great measure, proportioned to the frequency of its being cropped.* But the diminution of produce that must be incurred, has not, to the best of our information, been adverted to by those who are most interested in it; nor do these important facts in rural economy appear to have entered into their consideration. We are however convinced, from actual experiment, that the actual produce of the same field, by a judicious management *in this respect*, compared with bad management, may be augmented *fourfold* in the same season. Thus, instead of one acre and one-third (the usual proportion of pasturage allotted in England to one head), the fourth part will be fully adequate to the support of a beast during the six warmer months. Further, an acre of middling

* See Dr. Anderson's valuable "Essays on Agriculture, &c." vol. ii. disquisition 5, where this interesting fact is corroborated by experimental proofs, which our limits forbid us to introduce.

soil should produce 20,000 pounds weight of green, or 5,000 pounds of dry clover. A large cow requires 110 pounds of green, or twenty-seven pounds of dry clover *per diem*; consequently, in thirty-six days, she will consume 40,150 pounds, or somewhat more than the produce of two acres: whereas the same beast, if fed entirely out of doors throughout the year, would require a pasture of four acres. The Rev. Mr. Close, one of the ablest agriculturists this island can boast, has shown ("Communications to the Board of Agriculture," vol. iii.) that with clover, grass, lucern, and tares, a *treble number* of cattle may be supported in much better condition than by pasturing; and from the results of other trials, it appears to be equal to five, six, or even a larger number. But as it would swell this work to a disproportionate size, if we were to enter into farther details of the various successful experiments that have been made in soiling cattle, we refer the reader, who wishes for a more minute account of these, to the fourteenth volume of Mr. Young's "Annals of Agriculture," which contains full and interesting particulars of the extensive trials made by him and Mr. Hutcheson Mure, with reference to this subject.

The practice of soiling and stall-feeding cattle has also been adopted, to a considerable extent, on the continent, by Baron von Bulow and others; the result of whose experience is inserted in the first volume of the "Communications to the Board of Agriculture," by Dr. A. Thaer, physician to the electoral court of Hanover, which, he observed, has proved the following facts to be incontrovertible.

I. "A spot of ground which, when pastured upon, will yield sufficient food for only *one* head, will abundantly maintain *four* head of cattle in the stable, if the vegetables be mowed in proper time, and given to the cattle in a proper order.

II. "The stall-feeding yields at least double the quantity of manure from the same number of cattle; for the best and most efficacious summer manure is produced in the stable, and carried to the fields at the most proper period of its fermentation: whereas, when spread on the meadow, and exhausted by the air and sun, its power is entirely wasted.

III. "The cattle used to stall-feeding will yield a much greater quantity of milk, and increase faster in weight, when fattening, than when they go into the field.

IV. "They are less subject to accidents, do not suffer by the

heat, by flies and insects, are not affected by the baneful fogs that are frequent in Germany, and bring on inflammations; on the contrary, if every thing be properly managed, they remain in a constant state of health and vigour."

The facts and inferences above stated fully prove the advantages of soiling and stall-feeding; but, notwithstanding they are so obvious, there are not wanting persons who object to these practices, that bad seasons will happen, in which no grass can be cut and carried, on account of heavy rains or cold winds that retard its growth; and consequently, that it will be requisite to have some fields divided off, in which the cattle may find *pasturage*. To this objection it may be answered, that it will always be found a more safe and profitable plan to keep a quantity of hay in store, to meet the contingencies of unfavourable seasons, and to soil or stall-feed beasts in the manner above recommended; which we have seen practised to a considerable extent in towns, where cows are frequently kept on hay and straw throughout the year, and thrive exceedingly well. It ought not, however, to be concealed, that there are some inconveniences attendant on the soiling and stall-feeding of cattle; though, when compared with the disadvantages resulting from other methods, they are trivial. Such, for instance, is the additional labour and expense incurred by carting the green vegetables home to sheds, both in winter and summer. But these, Mr. Close justly remarks, are compensated, in a tenfold degree, by the increased value of the food, the thriving of the cattle, the making of the dung under cover, and having reservoirs in which to catch the urine. With this management, one good acre of turnips will produce an excellent dressing for an acre and a half of land, and will completely winter-fat an ox of fifty score. If fed on the land, two acres may fat an ox, but not so well; and the dressing will be very partial and precarious. Further, where large quantities of food are accumulated together for a considerable time, it is objected, that they are liable to fermentation, and of course to waste; such are cabbages, turnips, and other roots; so, where tares are left on the ground they are liable to become podded; in consequence of the butt-ends of the vegetables being of a coarse nature, and in a decaying condition, in which state they are uniformly refused by beasts. But these, and many other disadvantages that might be mentioned, may be obviated by paying due regard to the

storing of the various vegetable crops, and to the economical consumption of them; which subjects will be discussed in a subsequent chapter. It has likewise been objected, even by persons who in general approve of soiling and stall-feeding, that cattle will, by confinement during the summer months, be too much heated, and that their health will be affected; but surely stalls may be so constructed as to admit a regular circulation of air, and yet shelter them from the attacks of flies. Attention to both these particulars, indeed, is indispensably necessary to the preservation of the health, and the speedy fattening of animals; for, if kept too hot, they will perspire profusely, and their hides will itch; this vexes them exceedingly, so that they rub themselves violently against any post or wall within their reach, which necessarily retards their quick feeding. And, though the practice of currying and combing cannot, perhaps, be performed where there is *much live stock*, yet the beasts will greatly improve, if they be washed once at least in the course of the week.

When grass (whether natural or artificial) is to be given, it ought to be cut in the morning for the evening food, and in the afternoon for the morning mess; the afternoon crop should be carried to the barn, or some other convenient place, and spread out in order to exhale its superfluous moisture; and, in rainy weather, both crops must be taken off the ground. *Attention*, however, ought to be paid to the due proportion to be cut; and, until that fact be ascertained, it has been recommended by Mr. Bordley, an eminent agriculturist and breeder of the Western Hemisphere, to measure each mess, and to chalk down the quantity *in weight*, which the basket, cart-body, or other vehicle employed for carrying food, contains of the various articles used for that purpose. The practice will, at least, have a tendency to teach farm-servants to observe *method*, the value of which is of considerable importance in all business, particularly in the various branches that are connected with, or dependent on, a *grass farm*. On the supposition, therefore, that seventy-five pounds weight of green clover will be sufficient for one beast, he observes, that where thirty-two head of cattle are to be fed, 1,200 pounds will be cut twice in the day. Eight acres, cut four times in the season of soiling, will give one cutting in six weeks, or nearly thirty perches are cut daily. A man and a boy

may perform all the work, and pay all the attention requisite in soiling that number.

As the various grasses peculiarly calculated for grazing or soiling cattle, will be particularly detailed in a subsequent chapter,* together with the best modes of cultivating and storing them, we proceed now to state a few of those articles which have been found most useful for the purpose of winter, or stall-feeding, or of feeding in the farm-yard.

This branch of the grazier's management begins about the end of October, and lasts for about seven months, that is, till the commencement of May. Of all vegetable productions, *good hay* is undoubtedly the best for fattening cattle, when judiciously combined with straw cut into chaff by proper implements,† and with cabbages, carrots, parsnips, turnips, or similar succulent plants; though such hay, except on the most luxuriant soils, will rarely be found capable of fattening animals without the aid of other food. Barley, rye, oat and pea meal, when mixed together in about equal proportions, with the occasional addition of a small quantity of bean meal, may likewise be given with advantage, in the ratio of a quarter, or at most half a bushel, to each head of cattle, in conjunction with cut *hay*. Of the last-mentioned article it may be observed, that the hay made from grass mowed after the cattle, is usually employed for feeding live stock at the beginning of winter, the best being reserved for the spring, before the cattle are turned out to grass; and where a handful of salt has been thrown over each load, as packed in the loft, so grateful is this condiment to them, that they have been known to prefer poor hay *salted* to good hay *unsalted*. Singular as this fact cannot but appear, we have, in confirmation of it, the authority of Mr. Darke, of Breedon, one of the most celebrated graziers in the kingdom; who has mixed salt with his flooded, mouldy hay, in the proportion of only eight pounds to a ton; and who has declared that his Herefordshire oxen did better on it, than others which were supplied with the best hay he had; and that he was, and is convinced, that the hay derived all its good effects from the salt.

* Chapter VII.

† *Vide* Chapter V. where descriptions are given of the most useful straw or chaff-cutters, illustrated with engravings.

The most luxuriant of all vegetable productions, perhaps, is the *cabbage* with its numerous varieties, which, when combined with cut pea or oat straw, has been found singularly useful as winter fodder for *store stock*; and which, with the addition of excellent hay, will fatten oxen or bullocks in the short space of five months, beside yielding a larger quantity of manure than almost any other article used for winter feed; though the disagreeable flavour that plant is supposed to impart to milk has been assigned as a reason for disusing it; but such objection may be easily obviated, by *steaming* them in the contrivance which has already been described in Chapter II. Section II. § 7, p. 106, 107. Of *parsnips* we have spoken in the preceding section; at present, therefore, it remains only to add concerning these useful roots, that they have been employed on the experimental farm of the Marchioness of Salisbury, in the county of Herts, with remarkable success, not only for feeding store cattle, but particularly for fattening oxen, which eat them most advantageously; the benefit thence derived being, in the estimation of some graziers, nearly equal to that obtained from oil-cake (which will be mentioned in a subsequent page.) Next to parsnips we may class the *carrot*; a most useful root, the produce of which is so abundant that, according to the account of Mr. Young, *four* bullocks, *six* milch kine, and *twenty* work-horses were fed, a few years since, at Partington, in Yorkshire, for above *five* months, with carrots, the produce of three acres, with no other addition than a little hay throughout that period. He adds, that the milk was excellent in point of quality and flavour; and the refuse or waste, with a small quantity of other food, fattened *thirty* swine.

Turnips, especially when steamed, also supply a nutritive article of winter food; though, from their peculiarly moist nature, they will probably require to be combined with cut hay, to which a little barley or oatmeal may occasionally be added. But these roots, however beneficial in this country as an article of winter feed, have not succeeded in America, where an unfavourable opinion is entertained concerning them; for an intelligent grazier, in that country, having a more abundant crop than he could dispose of, determined to feed his cattle with them. The beasts were accordingly put up in October, and were fed till the month of February upon turnips: the animals did not thrive as he expected; on the contrary, they rather lost

flesh; though, on substituting hay, chopped potatoes, and the meal of Indian corn, they soon fattened. This difference of result, in the use of turnips, can only be accounted for by the supposition, that the turnips, containing a superabundance of moisture, produced too much laxity or scouring, and of course prevented the animals from taking on fat kindly.

In the county of Norfolk, however, which has long been celebrated for its turnip husbandry, there are very great numbers of cattle annually fattened for the London market, on little other food than turnips, which are given to them *whole*, and in a raw state; and it rarely happens that any animal is choked, or otherwise injured, by roots sticking in the throat. Should this accident, indeed, occur, the practice is to pour a horn full of salt and water down the beast's throat; and in case that does not succeed, Mr. Bayfield, an eminent grazier and farmer of that county, pours down a similar quantity of *salt and melted grease*, such as hog's lard, or any common grease; which preparation (except when it was applied in one instance too late) he has never found to fail of procuring relief to the animal in danger of suffocation.

Mr. Marshall, to whom we are indebted for the preceding circumstance, as well as for the subsequent particulars, conjectures, that warm oil and salt would perhaps have the same effect. Having stated this remedy, which we conceive to be justly deserving the grazier's notice, on account of its cheapness and facility, we now proceed to detail a few of the more striking points of the Norfolk mode of *turnip-fattening* cattle, which we trust will prove highly interesting.

The method in question is three-fold :*—According to the first plan, the roots are thrown on stubbles, grass lands, and fallows, to cattle abroad in the fields. This is the prevailing practice, the greater part of the cattle fattened in that district being fatted abroad: it requires the least attendance, and is allowed to be beneficial to light lands.

The general practice in the county of Norfolk is, to begin with the wheat stubbles, on which turnips are usually thrown, till they are broken up for fallow or barley. The next *throwing-ground* is frequently the barley stubbles, which receive the bullocks, (i. e. fatting and fatted cattle,) as the wheat stubbles

* Marshall's "Rural Economy of Norfolk," vol. i, p. 287.

are scaled in, and retain them until they are, in their turn, broken up for a turnip fallow. From Christmas till early in April, the clover lays only are thrown upon: and after these are shut up, in order to acquire a bite of rye-grass for the unfinished bullocks, the turnip fallows sometimes become the scene of throwing.

Occasionally, however, the farmers deviate from this mode; some objecting to the throwing of turnips on land intended for those roots the following year, under the apprehension that it produces the disease termed *anbury*.* In this case the clover lays succeed the wheat stubbles, some part of them being kept open till the turnip crop is finished in the spring. Sometimes young clover fields are thrown open; but this is regarded as bad management, unless the season is remarkably dry, and the surface of the earth is perfectly sound; nor is it often done unless there happens to be no clover stubble in the vicinity of the turnip piece.

But though the soil of Norfolk is, in general, remarkably dry, the farmers of that district are sometimes inconvenienced, in wet seasons, for clean ground on which to throw their turnips; and notwithstanding the value of *teathe*,† when the land will bear the bullocks, instances have occurred where farmers have requested their neighbours to allow them to throw turnips upon a contiguous piece of old lay-ground, or *olland*, as it is there called; preferring the loss of his *teathe* to checking his bullocks. On this account, therefore, Mr. Marshall recommends, in laying out a farm upon the Norfolk plan, so to intermix the crops, that there shall be at least two pieces of lay in the neighbourhood of each piece of turnips.

The turnips are thrown on the land in the following manner: a cart enters on one side of a close, in which stands a boy, who, as the vehicle is going regularly to the other, throws the roots

* The nature and probable cause of this affection in turnips will be stated, *infra*, Chapter VII. Section IV, where the culture of these roots is discussed.

† "This is an important word in Norfolk husbandry, for which our language has no appropriate synonym: it denotes the fertilizing effect of cattle upon the land on which they are foddered with any kind of food; whether such fertilizing effects be produced by their dung, their urine, their treading, by their breath, perspiration, and the warmth of their bodies."—Marshall's Norfolk, vol. i, p. 34.

out, with their tops and tails on, as they are drawn out of the ground; giving every part an equal share, and never throwing twice in the same place, until the whole has been gone over. In the commencement of the throwing season, while there is yet an abundance of grass for lean stock, the usual practice is, to keep the fattening beasts constantly in the same piece of wheat stubble, a fresh supply of roots being given them every day, or every second day at farthest.

When the clover stubbles are cleared from grass, and the store cattle begin to require assistance from the turnips, the fattening cattle have *followers*, i. e. rearing cattle: lean bullocks, cows, or store sheep follow them to pick up their refuse. In this case it becomes convenient to have three *shifts*, or three pieces of throwing-ground in use at the same time: one allotted for the head beasts, another for the followers, and a third plot empty, for the purpose of throwing turnips on it. Two pieces, or at least two divisions of the same piece, are indispensably necessary; and sometimes a row of hurdles is run across a throwing-piece, in order to separate the *bullocks* from the *followers*.

In throwing turnips, it is of great importance that they be thrown *evenly* and *thinly*, so that while a beast is breaking up one root, he cannot have it in his power to trample or dung upon another. But sufficient precaution is seldom taken to guard effectually against this inconvenience, though if turnips are cast at the distance of one yard asunder, they are not ill thrown, as they are too often dropped in rows, or clusters, of half dozens together.

Bullocks, which are on turnips abroad, are sometimes driven into the straw-yard at night, where the distance is not too great; and, occasionally, a little straw is given them under the hedge of the throwing-piece, where they continue entirely abroad. The quantity of straw thus consumed is very trifling; the object of it being merely to cleanse their mouths from the dirt of the turnips, on which alone the farmers place all their dependence for bringing their cattle forward.

Mr. M. remarks it as an interesting fact, that not one in ten of the highly-finished *bullocks*, which are annually sent to Smithfield out of Norfolk, taste a handful of hay, or have scarcely any other food whatever than turnips and barley straw, excepting such as are fattened off in the spring with ray-grass;

and a few that are fatted by superior graziers, who make it a point to give a little hay to their bullocks at turnips, towards the spring, when those roots are going off, and before the grass-lays are ready for their reception; an excellent practice, which ought, if possible, to be generally adopted, as without such precaution bullocks are liable to be checked in their progress between turnips and grass. Instances however have occurred, though rarely, in the county of Essex, in which Northumberland beasts, of the largest size, have been fattened on *turnips alone*, without the aid of any other food.

The second method of giving these roots to cattle is, by means of close bins, or small cribs, with boards or bars nearly close at the bottom, while the beasts are kept in a loose straw-yard. These bins are dispersed over the yard, and the turnips are put into them *whole*; the tap-root, and also the tops, unless they are fresh and palatable, being previously cut off, so that the fattening animals receive only the bulb; the tops, if eatable, being consumed by store cattle.

While the bullocks are in the yard, they have the straw sometimes given them in cribs, and at others it is scattered in small heaps about the yard, twice or thrice in the day; the quantity thus eaten is very trifling, and with the last-mentioned management, the yard becomes evenly littered without further trouble.

The mode of fattening here detailed is attended with somewhat more labour than the preceding method of throwing turnips abroad, which, in Mr. Marshall's opinion, is the preferable management, if the soil be sufficiently dry to support stock, and light enough to stand in need of being rendered firm by treading; on the contrary, where the land is deep, and the season is wet or severe, the straw-yard is the more comfortable place, provided it be kept dry and well littered, and be furnished with open sheds, in which the stock can shelter themselves. For, though the *teathe* of fattening cattle abroad is greatly beneficial to light soils, yet if bullocks, while fed in the yard with turnips, are well littered, they will make a large quantity of excellent manure, that will amply compensate for the additional labour thereby occasioned.

The third method, above referred to, consists in keeping the cattle tied up in hovels, or beneath open sheds, with mangers or troughs for receiving the turnips, which, in this case, are

frequently *sliced*, or more generally (though perhaps less eligibly) cut into quarters by means of a small chopper, upon a narrow board or stool, beneath which is a basket for catching the pieces. In this operation the turnip is held by the top, which, when wholly disengaged from the root (except the coarse part immediately about the crown) is thrown aside for the store cattle. The tap-root and bottom rind are separated with the first stroke, and suffered to fall on one side of the basket, so that the fattening animals have only the prime part of the plant.

Hence arises the quick progress in fattening, which bullocks fed under sheds sometimes make, especially in cold weather; but, from the increased trouble and expense consequent on this practice, though it requires less litter, it is confined chiefly to little farmers, who have opportunity to tend their own sheds. Under this treatment, the beasts have a little barley straw given them occasionally, in order to clean their mouths, and dry up the superfluous pieces of the turnip.

From the preceding facts and statements, Mr. Marshall conceives an eligible plan of management may be adopted, where circumstances will admit of it. In autumn, therefore, while the weather continues moderate, the bullocks may be allowed to remain abroad; but whenever it sets in very wet, or becomes intensely severe, they should be taken and kept under shelter, either until their fattening be completed, or the warmth of spring again invites them abroad.

To return from this digressive account of the Norfolk turnip-management, the importance of which, we trust, will be a sufficient apology for its length:—*burnet*, *sainfoin*, *whins*, *gorse* or *furze*, *lucern*, and the *mangel-wurzel*, or root of scarcity, having been mentioned in the preceding section, it is unnecessary again to point out the benefit to be derived from them in feeding cattle; hence we shall only remark, that the last-mentioned plant, as well as the *common red beet*, have lately been found to answer peculiarly well, not only for feeding, but also for fattening cattle: and, from some experiments made in the county of Hertford, they are superior to carrots, and nearly equal to parsnips. *Fir tops*, or the young and tender *shoots* of fir trees, have likewise been employed with effect in a case of emergency, as a substitute for other articles of winter fodder: of this circumstance we have a striking illus-

stration in the fifth volume of the "Letters and Papers of the Bath and West of England Society," where a correspondent states, that, being in great want of provender, and having scarcely any hay, he was compelled to feed his beasts on fir tops. And though he had more than four hundred head of neat cattle, yet he did not lose above *four* or *five* out of that number; while many graziers, farmers, and breeders, who resided in the same county, lost one-half, and several of them nearly the whole of their live stock. We state this fact, as it was communicated to the respectable society above mentioned; and would recommend attentive experiments to be farther made with this vegetable production, as, in the event of a scarcity of winter provender, it promises to be a salubrious and invigorating food, which might in a short time be collected.

Lastly, among the various vegetable productions that have been appropriated to the stall-feeding of cattle, *potatoes* will furnish an excellent supply, particularly when cut and steamed by means of the contrivance already referred to; and from the subsequent facts, they appear adequate to the fattening of neat cattle, in combination with a comparatively small portion of other food. In the eleventh volume of "Annals of Agriculture," we meet with the following statements relative to these roots, by J. H. Campbell, Esq. of Charlton, in Kent, an able and successful grazier, in answer to some queries that had been proposed to him by Mr. Young. He observes, that 100 bushels of potatoes, and 700 weight of hay are generally sufficient to fatten any ox that thrives tolerably well. The roots should, at first, be given in small quantities, which should then be gradually increased to one or two bushels per day; dry food being always intermixed, and the proportion of hay being uniformly regulated by the effect which the potatoes produce on the bowels. There ought to be at least *five servings* in the day; and according to the quantity of roots which a beast can be induced to eat with appetite, he will fatten the sooner, of course with less expense and more profit. The hay should be cut once, or if it be not very weighty, twice along, and three times across the truss, so as to be in square pieces of eight or ten inches, in which state the cattle will eat and digest it more readily, while their fattening is considerably expedited. The potatoes, however, according to Mr. C. need not be cut, except at first, in order to entice the beasts to eat them; but they

ought always to be *fresh* and *clean*. No corn or meal is necessary, unless it can be procured at a moderate price; in which case it would contribute materially to facilitate, and of course to render more profitable the whole system of cattle-feeding. Should a *scouring* be brought on by the use of raw potatoes, which often happens, the quantity of meal or other dry food given with them should be increased, until the beasts become accustomed to the roots, when this inconvenience will cease. In general, it ought to be regarded as a *fixed* rule, that when food artificially composed is to be given to cattle, it should be brought as nearly as possible to the state of natural food. Thus, if sugar or barley be given to them, some chopped straw or dry withered grass, or similar dry fibrous matter should be mixed with it, in order that the functions of the stomach and bowels may be performed in a natural way.*

In some districts where winter food is with difficulty procurable, it appears, that *heath* may be advantageously resorted to. In an interesting paper on this subject, communicated to the Board of Agriculture by James Hall, Esq., he states, that in the course of numerous experiments on furze, broom, rushes, bean-straw, and other neglected articles, he had discovered, that, if heath be cut when young and in bloom, and the finer parts be infused in a tea-pot, it produces a liquid very grateful to the taste, well flavoured, and extremely wholesome. Being anxious to know how far young heath might be useful to cattle, he tried the experiment on a cow. When first tied up, she refused to eat any of the heath, except the very finest part, nor did she appear to relish an infusion of it when set before her: hunger, however, compelled her first to drink the infusion, and then to eat the heath; and on this food only she lived for nearly a fortnight, during which her milk was reduced in quantity, though its quality was much improved. A similar experiment was made on a couple of sheep and an old horse, with nearly the same effect. Satisfied from these experiments that cattle may be supported for a long time by young heath, Mr. Hall proceeded to ascertain how far the plant was capable of retaining its valuable qualities when dried and laid up. He therefore cut some at the end of the summer, and dried it in the shade; and, at the end of two years it produced an infusion

* Sir Humphr y Davy's *Agricultural Chemistry*, p. 367

equally strong and well flavoured as at first; and the effect was the same at the end of three years. Mr. H. further states, that if heath be cut when in bloom, and boiling water be poured on it in a tub, an infusion will be produced, not only rich and pleasant, but capable of being made the basis of various valuable liquors; and that any quantity of young heath may be procured by burning the old which remains on the ground. The ashes afford an excellent manure, and generally cause a fine young crop to spring up: this may also be cut for hay at two or three years old, and may be given to cattle when fodder is scarce; but, when intended for this purpose, it should be carefully stacked and kept close, otherwise it will become less valuable.*

Having thus stated the various vegetable productions which have been beneficially employed in feeding and fattening neat cattle, we proceed to detail a few hints respecting other articles which are, or may be, likewise employed with advantage. For this purpose, *linseed-oil cakes*, have long been celebrated as eminently useful: they are asserted to have a very extraordinary effect on cows before calving, causing their milk to spring more copiously, and preparing the animals, in a fine way, for the critical period of calving. But as the fat of beasts, fattened on oil-cake, is not calculated for persons of gross habits of body, and, after being cooked, is of a loose flabby texture; and as the price of the cake has of late years greatly increased, it has been recommended to substitute linseed jelly, which is infinitely superior; and which, when mixed with a due proportion of hay or meal, affords an excellent composition for stall-feeding and fattening. It is prepared in the following manner: To seven parts of water let one part of linseed be put, for forty-eight hours; then boil it slowly for two hours, gently stirring the whole lest it should burn. Afterwards it ought to be cooled in tubs, and mixed with meal, bran, or cut chaff. Mr. Moody, an eminent grazier, already mentioned, gave two quarts of this jelly, *per diem*, to every large bullock, which proportion amounts to little more than one quart of seed in four days, and produces a great saving in the article of food.

In America, experiments have been tried with *linseed oil* mixed with the meal of Indian corn. The stall-fed steer, to

* Communications to the Board of Agriculture, Vol. vi. Part II.

which the composition was given, was observed to *thrive rapidly, and to sweat most profusely*; but, through inattention, too large a proportion of oil was given at one time with the food, which disgusted the beast, and occasioned the experiment to be discontinued. There can, however, be no doubt, but that linseed or flax-seed jelly is more agreeable to cattle than cake, while it renders them less liable to surfeit in case an extra quantity should be accidentally given, and is less liable to affect the meat with a peculiar taste than either oil or cake, and consequently it merits a trial. To each bullock, or fattening animal, therefore, about half a gallon of jelly may be given every day, mixed with meal and cut straw; but it will be requisite to change this food about a month before the beast is killed, to prevent, if possible, the flesh from retaining the flavour of the oil, cake, or jelly.

Cattle, fed on a mess of sour food, prepared by fermenting rye-flour and water into a kind of paste, and then diluted with water, and thickened with hay cut small, are also said to fatten quickly. This practice chiefly prevails in France, whence it was introduced into this country. Concerning the efficacy of acid food, in fattening animals, there is much difference of opinion. It is well known, that hogs derive more benefit from sour milk and swill than when those articles are in a fresh state; and it is highly probable, that sour articles may contribute to promote digestion, and by facilitating the consumption of a large quantity of food in a stated period, consequently expedite the fattening of cattle. But such acid messes can only, we conceive, be considered as preparatory to the more forcing and essential articles of dry food: without which it is scarcely possible that any steer, or bullock, can acquire that firmness of muscle and fat which is so deservedly admired, and considered as the criterion of excellence.

The *wash*, or refuse of malt, remaining after distillation, which was formerly applied exclusively to the feeding of swine, has of late years been applied with success to the stall-feeding of cattle. It is conveyed from the distillery in large carts, closely covered, and well jointed, in order to prevent leaking. The liquor is then discharged into vats, or other vessels, and when these are about two-thirds filled, a quantity of sweet hay, previously cut small, is immersed for two or three days, that the wash may imbibe the taste or flavour of the hay before it is

used. In this state it is carried to the stalls, and poured into troughs, whence it is in general eagerly eaten by cattle. Sometimes, however, the beasts are at first averse to this mixture, in which case it has been recommended frequently to sprinkle their hay with the wash; thus, having the smell continually before them, and seeing other animals eating the same composition with avidity, they gradually become accustomed to it, and at length greatly relish it. The cattle fed in this manner are asserted, not only to repay the expense of their keeping by fattening speedily, but also yield a large quantity of valuable manure.

One of the most successful instances of this mode of fattening cattle, which has occurred within our observation, is that of Messrs. Hodgson and Co. the public-spirited proprietors of Bolingbroke-house distillery, Battersea, near London.* They have erected stalls for fattening about 350 head of cattle at one time, with wash and grains, and a certain portion of hay *per diem*, with the view of enabling them to chew the cud. The beasts formerly stood or lay upon a framing of lattice-work, or trellis, (which was raised a little above the pavement,) and had neither straw nor haulm, but only the bare boards, for their bedding. But the unevenness of the surface being found exceedingly injurious to their feet, that practice has been relinquished, and the stalls are now paved with bricks.

Between October and April, which is their regular working season in the distillery, they fatten as near as may be 600; having generally about 350 in the house tied up at one time, and about 100 in an adjoining orchard to take in, to replace such as are sold off; or in consequence of any expectation of an approaching advance in the price of meat. They have no stated period for fattening these bullocks, being regulated entirely by the state of the markets; but from ten to sixteen weeks is about the usual time, and the cattle are found to gain, upon an average, from three to four stone per week. Their food is wash, grains, and hay, sometimes meadow, at others clover, and occasionally relieved by oat or barley straw, which is sometimes, though not regularly, cut into chaff: hay or straw is given to them twice a day, in order that they may ruminate, and as much grains and wash as they can eat. In general,

* Malcolm's Compendium, Vol. i. p. 355.

they come readily to this kind of food, though some are four or five days before they lose their aversion to it.

The stock fattened at the distillery above named, consists of cattle of every sort and size. There are many Scotch cattle, or kyles, as well as those reared in Northumberland, Wales, and Herefordshire, but none of the Sussex or Devonshire breeds, which Messrs. H. and Co. say are too dear for them. According to their quality, the cattle are supposed to pay from five to twenty shillings per week.

With equal success has molasses, or treacle, been employed; though the expense incurred by the use of this article will probably prevent its general adoption. It was first used in the West Indies by Mr. Millington, who found it, in combination with farinaceous substances, and, when these could not be procured, with cane-tops, oil-cake, and other articles of dry food, together with a little hay, or not too green fodder, greatly to expedite the fattening of cattle in general, and of old and decayed oxen in particular. He gave from half a pint to a pint of molasses, twice in the day, to every *starving* animal, which had been exhausted by continual and severe labour for a long series of years. In adopting this article, a gallon of oats, or other damaged grain, roughly ground, or the same quantity of potatoes, should be boiled in a sufficient proportion of water to form a thick mash. It must be well stirred while on the fire, to prevent it from burning, or sticking to the sides of the vessel; and, when it becomes cool, the mixture is to be formed into balls of about one pound weight each. These balls are divided into two equal portions, which, being previously immersed in the treacle, are given to the beasts in the morning and evening: they will devour them with eagerness, and will speedily thrive and fatten by the addition of a little hay, or any green fodder, that is not too succulent. Further: one or two spoonfuls of salt may be dissolved in the composition, which will contribute to preserve the health of the animals; and, in case corn cannot be conveniently procured and ground, pulverized oil-cake, diluted in water, and seasoned with a small quantity of salt, with the same proportion of molasses, may be advantageously substituted.

In the preceding facts and statements we have referred chiefly to the feeding and fattening of middle-aged and old cattle; young stock, however, require particular attention, lest their

growth be impeded, which no summer food can restore, and therefore should be fed on the best and most nutritive food the farm can supply. Hence, Mr. Young recommends yearlings to be fed during the winter with hay, turnips, carrots, potatoes, or other roots: where hay cannot be obtained, good straw must be substituted, the proportion of roots being increased and given with attention. For steers and heifers two years old, the proper food is hay, if it be cheap, or straw, with baits of turnips, cabbages, carrots, &c. In summer, their food varies so little from that above specified, as to require no particular details on this head.

With regard to oxen used in draught, it should be observed, that they ought to be well fed, and every attention bestowed, that no food be wasted, while they are to be kept in constant employ, particularly in the commencement of spring and in autumn, when their labour is most wanted. During those seasons, they may be supplied with abundance of cut hay and straw, with an allowance of from twenty-five to forty or fifty pounds weight of steamed turnips, cabbages, or carrots, per day; giving them, while at plough in autumn, such a proportion of oats and chaff as the size of the animal may require, because the grass at that time begins to diminish in its nutritive properties. In summer, the beasts may be soiled with green food, and in the winter stall-fed, in the manner and with the articles above mentioned.

But the most important object in the feeding or fattening of cattle is, that such arrangements should be made, and such a supply of food be provided for winter consumption, that the farmer or grazier may be enabled to keep them through that trying season, and sell them when meat fetches the highest prices, viz. from the end of February to the close of May, or beginning of June. By this procedure, he will not only obtain more for the sale of them than the autumnal markets would produce, but his stock will go off freely, and every market be in his favour. He will further obtain the largest possible command of manure, and consequently be enabled to conduct his business to the most profit. Next to a proper stock of keep for cattle, is *regularity in giving them food*. In stall-feeding, it is too common a practice to give a certain mess, or allowance, every day, without regard to any circumstance; the absurdity of which conduct is too obvious to be here particularly pointed

out. It is a fact, that a bullock or fattening beast will eat with a keener appetite on a cold day than in warm, damp weather; hence his mess ought to be proportioned accordingly. By giving the same quantity every day, the animal may be induced to over-eat himself; thus his appetite becomes impaired, the food is wasted, and several days will necessarily elapse before he can recover his natural appetite. By such delay he must fall away, and many weeks, perhaps months, will be required to bring him to his former good flesh.

The relative proportion of food consumed by fattening beasts necessarily varies, according to the size of the animals, and the nutriment afforded by the respective vegetables. It has, however, been found, that an ox will eat something less than one-fifth *per diem*, of his own weight of cabbages. Fattening beasts require from about one-third to one-half of their weight of turnips, beside an adequate allowance of dry meat to counteract the superabundant moisture of these roots. An acre of twenty-five tons, therefore, will fatten a beast of sixty stone, or something more. For middle-sized animals a bushel, or a bushel and a half, of distillers' or brewers' grains will be sufficient, if combined with an ample portion of cut hay, chaff, or bean straw, given between the intervals of allotting the grains. Bullocks, or oxen, varying from forty-five to sixty stone, consume about eight or ten stone of carrots or parsnips *per diem*, beside an additional quantity of dry provender; that is, in the proportion of one-sixth part of their own weight; and, as an acre of carrots will yield 400 bushels, or 22,400 lbs. it would support such an ox 160 days, (i. e. between five and six months); a period which Mr. Young thinks is too long for beasts to be kept that have had the summer's grass. If they are half fat when put to carrots, he states that an acre would be sufficient to fatten two such beasts. Of potatoes, small cattle (such as those of Wales and Scotland) eat every day about one bushel per head, in a raw state, with an allowance of one truss of hay divided between four beasts. To an animal of eighty or one hundred stone, about ten or twelve pounds of pulverized oil-cake are given each day, with half a stone, or one stone of cut hay, in addition, every day, for seven or eight weeks, which allotment of cake is then usually increased to eighteen pounds *per diem*, until the animal is sufficiently fat for sale.

But whatever articles of feed may be given, they ought to be

apportioned with as much regard to *regularity of time* and *quantity* as is practicable; and if any small part be at any time left unconsumed, it should be removed before the next feed is given, otherwise the beast will loath it. Hence three periods of the day, as nearly equidistant as possible, should be selected, when such an allowance should be given to each animal as he can eat with a good appetite; which point can be regulated best by attending duly to the state of the weather, or season; thus the beast will improve progressively and uniformly, while a trifling loss of food only can occur by such method. It may, however, be remarked, in general, that the larger a bullock is, the more he requires to support him, though some beasts will consume nearly the same proportions of food throughout the period of their fattening. And in order that this important branch of rural economy may be properly conducted, the young grazier will find it serviceable to weigh each beast once a fortnight, at the least, before he gives the morning allowance, by which he will be enabled to form an accurate estimate of the real progress his cattle make in thriving. If they do not continue to advance, according to the result of former weighings, it will be necessary to change their food; and as bullocks will take less meat every week after their kidneys are covered with fat, it will be well to weigh them once a week, as a more adequate idea of their thriving may thus be formed.

Of equal, if not superior importance with *regularity in feeding* is *cleanliness*, a regard to which is admitted, by all intelligent breeders, to be one of the most essential requisites to the prosperity of cattle. Hence not only ought they to be supplied with abundance of pure water, as already intimated;* but also, whenever they are brought into the stalls, either from pasture or from work, their feet ought to be washed, lest any filth should remain there and soften their hoofs. Further: frequent washing after hard labour, or at least once in the week, should be performed; and, though the practice of currying and combing, or of friction with brushes, cannot perhaps be adopted, or carried into effect, where the herds of beasts are numerous, yet, we conceive, they might be often rubbed with a wisp of straw to considerable advantage. The mangers and stalls should likewise be kept as clean as possible; and the former, if they

* *Ante*, Chapter II. Section II. § 8. p. 106.

cannot often be washed, should be cleared every morning from dust and filth, which may be easily effected by means of a common, blunt-pointed bricklayer's trowel. After the stalls have been cleansed by constantly removing the dung and sweeping the pavement clean, a sufficient quantity of fresh litter ought to be strewed over, which will invite them to lie down; for nothing contributes more to expedite the fattening of cattle than moderate warmth, ease, and repose. In fact, where *straw* can be obtained at a moderate price, supposing the farm does not yield an adequate supply for this purpose, the stalls and farm-yards ought always to be well littered, especially during the winter season. The quantity of manure thus made is an essential object; and the following interesting hints on this subject, selected from Mr. Young's valuable Calendar, will show certain proportions of dung to straw. Mr. Moody, whose improvements we have already had occasion to notice, littered forty-five oxen, while fattening, with *twenty* waggon-loads of stubble, by which he raised *two hundred* loads, each *three* tons, of rotten dung, worth 7s. 6d. *per* load.

Every load of hay and litter, given to beasts fattening on oil-cake, yields *seven* loads of dung, of *one ton and a half* each, exclusive of the weight of the cake. And, on comparing the dung obtained by feeding with oil-cake with that of the common farm-yard, it has been found, that the effects produced by spreading *twelve* loads of the former on an acre, considerably exceeded those of *twenty-four* loads of the latter manure. By another trial made by Mr. W. White, it appears, that thirty-six cows and four horses, when tied up, ate *fifty* tons of hay, and had *twenty* acres of straw for litter; they made *two hundred* loads of dung, in rotten order for the land. Hence, it appears, that straw may be safely purchased, even at a high price, with a view to the great benefit that may be derived from the dung. But, with all the advantages thus to be derived from litter, the cattle will not thrive, unless every species of carrion and filth be removed, lest they should generate any distemper, especially the dung of poultry and swine, to which neat cattle have great aversion.

Having now stated the leading facts and experiments that have been made on the subject of feeding and fattening of neat cattle, we shall conclude the present section with a few remarks on the *sale* of beasts, when properly fattened for that purpose.

In order to ascertain this point, the following hints may, perhaps, afford some criterion. First, when the general shape and composure of an animal appear best proportioned, each member being comely, and each bone covered with flesh in the manner required to constitute a perfect shape, it may be concluded that the beast is well fed; especially when his hip-bones, or, as they are sometimes termed, his huckle-bones, are round, his ribs smooth and not sharp, his flanks full, and cod round. When these marks are perceptible, the beast may be handled, and his lowermost ribs felt; if the skin be *kindly* or *mellow*, that is, soft yet firm to the touch, it is certain that he is well fed outwardly, or in other words, upon the bones. Next, the hand may be laid upon his hip or huckle-bones, and if they likewise feel soft, round, and plump, it may be safely concluded that the animal is well fed, both externally and internally; that is, both in flesh and in tallow. Further: he may be handled at the setting on of his tail, which, if it be thick, full, and soft to the touch, is also an indication that the beast is well fed externally; the same circumstance is likewise evinced by the *nach-bones*, which lie on either side of the setting on of his tail, feeling mellow, or soft and loose. Lastly, the cod may be examined, if an ox, or the navel of a cow, and if they respectively feel thick, round, large, and plump, it is a certain criterion that the beast is well tallowed within; though, when any of these parts or members handle contrary to the rules above mentioned, a contrary judgment must be formed.

After all the attention and labour which the grazier may bestow, his hopes are liable to be frustrated, in some measure at least, unless he select a proper time for the disposing of his fat cattle. The most common season for beef is at Michaelmas, when the markets are more abundantly and more cheaply supplied than at any other period of the year; as the numerous cattle which have been fattened on luxuriant pasture grounds, are then brought for sale. Hence the attentive grazier will find it most beneficial, at this time, to dispose only of part of his stock. Beasts are chiefly driven to London for sale; and, where the distance from the metropolis is very considerable, they are liable to very many calamities or accidents on the road, to omit their diminution in point of weight; which, even under the eye of the most attentive drivers, is necessarily incurred, and is often great: while, from the fluctuation of the

markets, like that of the funds at the Stock Exchange, his risk is very considerable. It will, therefore, be advisable, where it can be conveniently or advantageously effected, to dispose of fat stock in such markets as are in the vicinity of, or at an easy distance from the farm.

In drawing off one or more lots of cattle for sale, it is the general practice to dispose of the fattest animals, and to keep those which do not fatten kindly for additional exertions. Such procedure may, indeed, as Mr. Young has observed, be admitted to a certain extent, if the food provided be not expensive: but, if the beasts are reserved for corn or cake-feeding, or if the supply of other food is precarious or limited, this conduct is highly questionable. Costly food should on no account be given to cattle that have evinced themselves to be unthrifty; on the contrary, the most thriving animals in the lot ought to be chosen for this purpose, for the pursuing of an opposite conduct has often been the reason why all winter fattening has been so heavily censured and condemned. As soon as a grazier is fully convinced, that he has a beast which is not kindly disposed to take on fat, or is an *ill-doer*, the *first* loss is obviously the best, and he should dispose of the unthrifty animal the earliest opportunity.

The common mode of selling cattle for slaughter is by *lots*; and, in this case, to prevent confusion between the parties, or loss on the part of the feeder, care should be taken to fix the precise time in which any particular lot is to be drawn, in order that no unnecessary food may be consumed. Formerly, and even now, in some places, it is usual to sell by the *eye*, a method which is certainly unequal as it respects both the farmer and the butcher; for the former, unless he has been accustomed to weigh his beasts during the progressive stages of their fattening, can form at best but an uncertain idea of their weight; while the latter, from his continual practice, is enabled to form a tolerably accurate estimate. Hence some have killed a beast out of a particular lot, with a view to ascertain the average weight of animals in such lot; and, in order to induce a perfect equality between the buyer and seller, it was proposed by the late Lord Kaimes to dispose of every beast by weight, and that such weight should be ascertained by the steel-yard, as being best calculated for weighing heavy goods; which mode he used with ease and success for many years.

With regard to *fat calves*, we would observe that, in general, by weighing the animal alive at the time of sale, and from the gross weight, deducting eight pounds from every score, to be allowed to the butcher, the remainder will prove to be the weight of the four quarters. This rule may be illustrated by the following example: A farmer has occasion to know the value of a calf at 8d. per pound; properly securing him so as not to hurt the beast, he weighs him with scales or steel-yard, or in a weighing-machine, and finds the weight to be ten score, or 200 lbs. From this weight let eighty pounds, or eight pounds from each score, be deducted; the remainder will be 120 lbs. the weight of the four quarters very nearly; which, at 8d. per pound, will be 4l., and so of any other weight or price. As this rule will not, in general, vary more than four ounces, or half a pound in a quarter or side, it will be found to answer sufficiently well for the purpose.

It is not, however, sufficient to ascertain the weight of a living fatted beast, or bullock. Different parts of the same animal are different in their value: and, as he observes, there is a rule for ascertaining the proportion of these various parts, by which their weight may be known with almost equal certainty as the weight of the whole beast. But, before we proceed to specify such rule, it is necessary to premise, that the following proportions are calculated chiefly for Scotch cattle, to which only Lord Kaimes' experience reached; but, as great numbers of these are fattened in England, especially in the county of Norfolk, we trust the annexed hints will be found useful.*

The four quarters† constitute half the weight of the bullock; the skin is the eighteenth part; the tallow the twelfth part; making twenty-three thirty-sixths, or about two-thirds of the whole; the remaining third part, or a little more, is composed of the head, feet, tripe, blood, &c. which offals never sell by weight, but at a certain proportion of the weight of the beast.

* For ascertaining differences between venders and purchasers of cattle, we know of few more useful manuals than Renton's "Grazier's Ready Reckoner," (12mo. 2s. 6d.) consisting of tables calculated to determine, by admeasurement of a beast's body, the weight of any animal within certain limits, sinking the offal; and accompanied with rules for taking such measurement.

† Kaimes' "Gentleman Farmer," p. 209.

They commonly produce 10s. 6d. when the bullock weighs one hundred Dutch stone, and so on in proportion. These particulars being adjusted, the next point which the seller is to ascertain is the market-price of butcher's meat, tallow, and hides. Supposing the bullock* to be sold is seventy-two stone living weight, the four quarters make thirty-six stone, which, at 4s. per stone, or 3d. per pound, amount to 7l. 4s. The hide is worth 16s. at 4s. per stone; and the tallow, being 5s. 4d. the stone, is worth 1l. 12s. sterling. The offals, according to the proportion above stated, will give 7s. 6d.; and, by that computation, the value of the bullock is 9l. 19s. 6d. which answers to 2s. 9½d. per stone, living weight. And therefore, if a butcher agree to give that sum per stone, no more is necessary to ascertain the price of the whole carcase than to weigh the beasts, three or four together, as the scale can hold them. But out of this sum must be deducted the butcher's profit, which cannot be much less than 5l. per cent. though we believe it is at present somewhat more.

The weighing of cattle alive, as Lord K. remarks, answers another purpose, viz. to discover whether the feeder gets the value of the food by the additional weight of the beast. For instance, supposing the food of a bullock costs 9d. *per diem*, or 5s. 3d. per week; if the animal does not take on two stone per week, the keeper is a loser, and, as already intimated, it will be highly imprudent to keep such a beast on hand, unless in expectation of a rising market.

Thus having attempted to compress into one view the various important facts that are connected with this department of our work, we shall conclude with the two following tables, selected from Lord Somerville's valuable tract, intituled "Facts and Observations relative to Sheep, Wool, Ploughs, Oxen, &c." (8vo. 1803), in which are exhibited the various weights adopted in different counties and districts for equalizing the different modes of calculation.

* As the weight of beasts varies accordingly as their bellies are more or less full, it is necessary to state, that the proportions above stated were made out when the cattle were weighed at eleven o'clock in the forenoon.

TABLE

FOR THE

EQUALIZATION OF DIFFERENT WEIGHTS.

Scores.	Stones at 14lb.		Stones at 8lb.		Scotch Stones 16lb.		Hundreds, 112lb.		
	st.	lb.	st.	lb.	st.	lb.	cwt.	qrs.	lb.
20 equal	28	8	50	0	25	0	3	2	8
25 ..	35	10	62	4	31	2	4	1	24
30 ..	42	12	75	0	37	4	5	1	12
35 ..	50	0	87	4	43	6	6	1	0
40 ..	57	2	100	0	50	0	7	0	16
45 ..	64	4	112	4	56	2	8	0	4
50 ..	71	6	125	0	62	4	8	3	20
55 ..	78	8	137	4	68	6	9	3	8
60 ..	85	10	150	0	75	0	10	2	24
65 ..	92	12	162	4	81	2	11	2	12
70 ..	100	0	175	0	87	4	12	2	0
75 ..	107	2	187	4	93	6	13	1	16
80 ..	114	4	200	0	100	0	14	1	4

TABLE OF PRICES.

Scores at	3 $\frac{1}{2}$ d.		4d.		4 $\frac{1}{2}$ d.		4 $\frac{3}{4}$ d.		5d.		5 $\frac{1}{2}$ d.		5 $\frac{3}{4}$ d.		6d.		6 $\frac{1}{2}$ d.		6 $\frac{3}{4}$ d.		7d.		Difference.		
	l.	s.	l.	s.	l.	s.	l.	s.	l.	s.	l.	s.	l.	s.	l.	s.	l.	s.	l.	s.	l.	s.			
1	0	5	0	6	0	7	1	0	7	11	0	8	0	8	0	9	0	10	0	11	0	11	0	5	
2	0	10	0	12	0	14	2	0	15	0	16	0	17	0	18	2	1	0	1	1	2	1	3	0	
3	0	16	0	18	0	20	1	0	21	1	3	9	1	4	3	1	10	1	11	3	1	13	9	0	
4	1	1	1	8	1	10	1	1	11	8	1	13	1	15	0	1	16	8	1	18	4	2	6	0	
5	1	7	1	9	2	11	3	1	12	7	2	1	13	2	3	2	5	10	2	12	1	14	2	1	
20	5	8	4	16	5	10	6	7	18	4	8	6	15	0	9	3	4	10	8	15	0	13	4	0	
25	6	15	7	5	7	10	7	9	17	11	3	10	18	11	9	3	4	11	8	10	1	14	1	0	
30	8	2	6	15	0	9	7	6	10	0	10	12	6	11	5	0	11	7	12	10	13	0	10	12	6
35	9	7	10	4	2	10	18	11	13	4	12	7	11	13	2	6	13	17	14	17	14	10	14	7	
40	10	16	8	11	13	4	18	0	13	6	14	3	4	15	0	15	16	16	13	16	10	13	9	8	
45	12	3	9	13	2	6	14	1	15	0	15	18	9	16	17	6	17	16	13	16	10	13	9	8	
50	13	10	14	11	8	15	12	6	16	13	4	17	14	2	18	15	0	19	15	10	10	13	4	0	
55	14	17	11	16	0	10	17	3	18	6	19	9	2	20	15	0	19	15	10	10	13	4	0	10	
60	16	5	0	17	10	0	18	15	0	20	0	21	5	0	22	10	0	23	15	0	23	15	0	11	
65	17	12	1	18	19	2	20	6	32	13	4	23	0	5	24	7	6	25	14	7	14	7	1	0	
70	18	19	2	20	8	4	21	7	6	23	6	24	15	10	26	5	0	26	11	0	26	11	0	1	
75	20	6	3	21	17	6	23	8	9	25	0	26	11	3	28	6	29	13	9	31	0	2	2		
80	21	13	4	23	6	3	25	0	26	13	4	28	6	8	30	0	31	13	4	35	6	4	1		
85	23	0	5	24	15	10	26	11	3	28	6	30	2	1	31	17	6	33	12	1	17	6	1		
90	24	7	6	25	5	0	28	2	6	30	0	31	17	6	33	15	0	35	12	1	17	6	1		
95	25	14	7	27	14	2	29	13	9	31	13	4	33	12	11	35	12	11	35	12	11	35	1		
100	27	1	8	29	3	4	31	5	0	33	6	35	8	4	37	10	0	39	11	8	4	1	8		

SECTION III.

On feeding and fattening Sheep.

IN a former part of this work, the best modes of supporting ewes, during the period of gestation, and while they suckle their lambs, have been stated;* it now remains to specify the most useful methods of feeding and fattening them after they are formed into flocks. Before, however, we proceed to discuss this branch of rural economy, it will be necessary to state the names or terms by which these animals are known at different ages, and in various counties. From the time of weaning to the first shearing, the *males* are denominated *hogs*, *hoggets*, or *hoggerels*, after which they receive the appellation of *shearing*, *shearling*, *shear-hog* or *diamond tups*, or *rams*; after that they are called *two*, *three*, or *four shear*, according to the number of times they have been shorn. When male sheep have been castrated, they are termed, from the period of weaning to that of shearing, *wether* or *wedder hogs*, then *shearings*, *shearlings*, &c.; after they have been shorn a second time, they are denominated *young wethers*, or *two-shear wethers*, then *three*, *four*, or *five shear wethers*, according to the number of clippings or shearings they have undergone. The females have the appellations respectively following:—from the time of weaning to the first shearing they are termed *ewe* or *gimmer hogs*; they then take the name of *gimmers* or *theaves*, which continues only for one year, after which they are invariably denominated *two*, *three*, or *four shear ewes*;† and, when old, they are termed *crones*.

The successful feeding of sheep must greatly depend on the quality of the pasture intended for their reception, and upon the resources which the farmer has for supplying them with food during the trying winter months. Hence, as already intimated, it will be necessary to *suit* them to the pasture, and on no account to purchase or procure sheep from grounds of a superior quality to those which are destined for their support. With sheep, as with other cattle stock, it has been found that

* *Ante*, pp. 72—74.

† Culley on Live Stock, p. 18. For ascertaining the 'age of sheep, vide p. 32.

the larger breeds are calculated only for the richest and most luxuriant grounds, while the smaller sorts are best adapted for the less fertile tracts, where the grass is shorter; and as the breeds that are most beneficial for particular situations are detailed in the introductory view prefixed to this work, we shall here only remark, that the *Dishley*, or *New Leicester*, and the *South Downs*, are particularly calculated for the last-mentioned description.

In the grazing of sheep, as well as neat cattle, various methods are practised, and with different success. Thus, some farmers buy two or three shear wethers early in May, which, for several weeks, are indifferently kept till all the hay has been carted off the meadows, when they are turned into the rough, or after-grass, and are afterwards *forced* or fattened off during the winter months, so as to be fit for sale at the commencement of March. This practice is very beneficial, if conducted with care, as mutton fetches the most advantageous prices in that month. Another lucrative method consists in purchasing pregnant ewes towards the close of summer, or early in the autumnal quarter; and keeping them on inferior grass lands, stubbles, or fallow, till the beginning of the following year, when they are kept in good condition through the lambing season, and after that in the best manner possible, so that the lambs may be ready for sale in sufficient time for the dams to be fattened for the butcher early in autumn.*

Another profitable practice is, the buying of lambs, whether castrated or not, about the end of August, or in the beginning of the following month. The animals thus acquired are, by some graziers, kept in an indifferent way throughout the winter, till early in April, when they are fattened so as to be ready for sale in August, or are continued to the middle or end of September, at which time the whole stock are cleared off the land. Others, however, adopt a system altogether the reverse of this: having purchased the sheep, as already stated, they force them with the best keep that can be procured, and dispose of them as quickly as possible.

In grazing sheep, the same remarks are applicable as have been specified in the preceding section. Hence we shall only

* For the supporting of ewes and lambs during the period above referred to, *vide* p. 74—77.

observe, that the fine grasses* produced on downs are, undoubtedly, the best and most congenial food for these animals: good hay alone will fatten wethers, which may be yet more advantageously prepared for the butcher by means of grass and hay together. Great attention, however, is necessary, that sheep be kept from all grass that is made gritty in consequence of inundations, otherwise they will become affected with the rot. And here it may not be amiss to remark, that the late Mr. Bakewell attributed this fatal disease solely to flooded lands, and the premature, but unsubstantial, herbage afforded by them. Whenever, therefore, particular lots or parcels of his sheep were past service, his practice was to fatten them for the butcher; and, probably from motives of jealousy, in order that he might be certain the animals would be killed, and not go into other hands, he used to rot them before they were disposed of. This he affected by overflowing a pasture or meadow in the summer, in consequence of which the soil thus flooded inevitably rotted the sheep that were fed on it the ensuing autumn.

Beside humid situations, and the acid grass vegetating there, it will be proper to see that no horses be pastured along with sheep; for experience has proved, that the tufts of long, rank grass that usually spring up after horse-dung, will communicate the rot, unless the grass has been previously exposed to a few nights frost, after which they may be turned in without danger. It is also dangerous to suffer sheep to browse upon the grain, especially that of barley, which shoots up among the stubble after the harvest is completed; and fallows, that are wet and unsound, are equally detrimental, whether the soil be *light* or *strong*. In the former situations, they frequently pull up the herbs by the roots, which they eat with the dirt adhering to them, which will inevitably give them the rot; and if the fallows be strong land, and should not afford a sufficient supply of food, they are liable to the hunger-rot, from being compelled to eat the rank, unwholesome vegetables produced on such grounds; especially the lesser spearwort (*Ranunculus flammula*, L.) and the marsh pennywort (*Hydrocotyle vulgaris*, L.); both of which plants flourish on wet situations, and ought carefully to be eradicated wherever they are found. In such pastures, however, as are subject to give sheep the rot at certain

* On the subject of grasses, vide Chapter VII. Section I. II. III.

times, it will be advisable to let the lambs run with the ewes, the longer the better; for though these tender animals are more susceptible of injury in those unsound places than full-grown sheep, yet they are seldom attacked with the rot, suckling having been found a preservative against it.

Further, in turning sheep into pastures, particularly water meadows, and also into those places that are subject to rot, it will be necessary to pursue the same precaution as with neat cattle, viz. previously to satisfy the craving of appetite, by giving them hay or cut straw; and, after the dew has been evaporated by the rays of the sun, to drive them gently round the field for two or three hours, before they are suffered to feed. But, whenever any sort of dry food is given, they ought to be supplied with *pure water*, particularly during the intense heat that usually prevails during the *dog-days*, and which often renders the grass as dry as stubble. For this purpose, clear, light running water is always to be preferred, where it can be obtained; though, in general, whatever water presents itself is made use of. But, where this necessary of life is found only in a tainted state, or overcharged with the juice of dung, it will be advisable to give them well-water in troughs, or shallow tubs. This must be particularly attended to in the folds, so long as the sheep are confined there by the severity of the weather.* It has likewise been recommended to *fold* these animals before the dew falls, and to keep them in fold until it exhales, both in the

* The watering of sheep is, on the continent, regarded as a circumstance of the greatest moment, and accordingly receives that attention which it requires. Thus in Sweden, and at the national farm at Rambouillet, in France, they are daily watered with running water, or with that obtained from lakes or springs; *stagnant* water being most properly and rigorously prohibited. In some of the Saxon sheep-farms, the sheep are watered in the cots or folds during the winter, instead of taking them to watering-places. Spring or well-water is conducted, by means of pipes, into troughs, out of which the sheep drink at pleasure; they in consequence drink oftener, and each time take less water, which is favourable to their health. The ordinary mode of watering sheep in that, and we may add, in many parts of our own country, is attended with many inconveniences. The animals refuse to drink water in the winter, if it be too cold; they hurry while drinking; and do not take enough when the weather is very windy, or hail, rain, or snow falls. Beside which they often disturb the water with their feet; this disgusts them, and, at length, one part of the flock completely prevents the other from approaching the watering-place.

spring and in summer, feeding them with hay or similar dry food.

The best time for turning sheep into summer pastures is in May, when every attention should be paid to proportion the sheep according to the luxuriance of the grass; and, as these animals are with difficulty restored to good condition when injured by want of sufficient food, it will be advisable rather to understock than burthen the land with too large a number. The average allotment of these animals to an acre of clover may be from four to six or seven; though there are some situations which will carry still more.

In the distribution of sheep there is another circumstance worthy of notice—the profit which may be derived from pursuing a system of *close-feeding*; thus the plants will not only be prevented from running up to seed, and consequently, being preserved longer in the leaf, will afford a greater supply of food, but also those grasses, which are naturally coarse and unprofitable, will be kept down, and become sweet and valuable.

With regard to the practice of folding sheep, there is a difference of opinion among graziers and breeders. The period chosen for this purpose is the month of May; and, as Mr. Young has justly remarked, this practice is (when relied on) of such importance, that it should be steadily pursued. Many farmers give a very slight dressing, one night in a place, and the fold three square yards per sheep; whereas they ought to be folded two nights in the same spot, and one, or at most two, square yards allotted to each animal. If arable, the ground should be perfectly black, and if grass, well covered with dung. For this purpose turnip and cabbage fallows are best calculated, as those vegetables, being sown and planted in June, will consequently derive immediate benefit.

These hints, however, are given on the supposition that the openness or other circumstances of the farm render the practice of folding necessary; for though it still prevails in some districts, yet it is attended with many inconveniences, which have induced several eminent farmers to discontinue it. Not only, indeed, are those lands, which are in any degree moist, liable to be poached by the treading of the animals, but also these, by being driven three or four times in the day to the fold, are liable to be excessively fatigued; so that the stronger sheep only can feed without receiving much detriment. Besides, young lambs

are often seriously injured; the ewes are liable to be hurried and heated; and as the sheep are, in fact, moving throughout the day, the weaker animals are thus prevented from feeding at pleasure, while no inconsiderable portion of food is trodden under foot, and irreparably wasted.

The late eminent Mr. Bakewell was decidedly averse to the practice of folding; considering the advantages, supposed to be derived from it as visionary, as, in fact, robbing a large portion of a farm in order to enrich a small part. He was of opinion that the keeping of large flocks together, even of any number exceeding a hundred, is a barbarous practice, as the strongest will always consume the best food, which ought to be appropriated to those which are less hardy; and observed, that if folding be necessary on farms that have no commons appendant to them, why should there not be different small folds, on different parts of the farm, for animals of various ages, kinds, and strength, and thereby save the trouble of driving them from one part of a farm to another? For, is it not preferable, after the animal has filled its belly, that it should lie down to sleep (and let it not be forgotten that repose contributes materially to promote fattening) than travel, in order to create an appetite?—From extensive and accurate observation, in various parts of this island, Mr. Bakewell became confirmed in his opinion of the inefficacy of folding; and his example has been followed by Messrs Young and Coke (two of our most enlightened agriculturists), both of whom have relinquished the practice.

The idea above suggested, by Mr. Bakewell, of keeping sheep in small flocks, is very important, and productive of much advantage; it has been adopted, in its full extent, by Mr. Boys, of Betshanger, in Kent, who has divided his numerous sheep into four flocks, each of which is committed to the care of a distinct shepherd; and who is so convinced of the profit of his conduct, that he would not for a moment admit that any question could be made of it.

Having already pointed out the most useful criteria for separating sheep into small flocks (p. 82—84), we shall only observe, that though *straggling* folds are evidently an expensive as well as injurious practice, every advantage which can be expected from them may be derived by having *standing* folds, either erected on dry spots, and in the most convenient parts of the farm (where this is very extensive); or (which is preferable) a

part of the farm-yard may be fenced in, and provided with sheds open towards the sun, and having pens for receiving the flocks accordingly as they are separated, so that the sheep may be let out to exercise themselves on the land for a few hours in the middle of the day, unless the weather be extremely unfavourable. In this system of *cotting*, the floors of the various sheds ought to be covered with chalk, well beaten in, and laid on a slight declivity, for the discharge of the urine, which, as well as the dung, should be frequently removed, for cleanliness is essential to the thriving of these animals. The practice here stated will, indeed, render an abundant supply of *litter* necessary; but the additional expense thus incurred is more than compensated by the ample supply of manure thereby obtained, as the following fact will fully prove. Mr. Arbuthnot penned 134 sheep and 30 lambs, for six weeks, in a standing fold, and littered them with five loads and forty trusses of straw, which produced *twenty-eight* large loads of dung. They were fed morning and evening in the fold with turnips, and, during that time, consumed two acres of those roots.—The annexed account will evince the benefit of this practice more clearly than any remarks we can add on the subject:

Value, dung - - - - -	£.10 0 0
Straw, at 20s. - - - - -	5 15 0
Profit - - - - -	£.4 5 0
Per acre for tunips - - - - -	£.2 2 0
And per score per week - - - - -	£.0 1 9½

Having, in a former chapter,* stated the most eligible mode of supporting ewes and lambs through the trying seasons of winter and spring, previously to their being turned into summer pastures, we shall subjoin a few supplementary remarks on the most useful articles of winter food.

Of late years, it has become a frequent practice to soil sheep during summer with the various artificial grasses, with cichory, tares, green peas, and beans; and to supply them with

* See pp. 69—84.

corn, as well as green food, during the winter. In this view, barley-meal, when abundant and cheap, may be advantageously combined with green meat, and will speedily fatten wethers: pulverized oil-cake has also been given; but as it is apt to impart a peculiar flavour to mutton, it may be beneficially replaced by corn, ground or in a green state, by hay, straw, and fog, or after-grass reserved for this purpose. Borecole and burnet also supply excellent food for sheep during the winter, particularly towards the close of that season. But few vegetables are at present in greater request than turnips, as an article of winter keep; they require, however, to be sliced, to prevent accidents; as also do potatoes, which, when steamed or baked, contribute rapidly to fatten sheep.

There are, however, various methods in use of giving turnips to sheep; by some farmers, they are promiscuously turned into a field, and allowed to eat the roots at pleasure; but this practice is by no means economical, as many turnips must necessarily be trodden under foot and spoiled with dung. Others divide their land by hurdles, and inclose the sheep in such a space as these can clear in one day, advancing progressively through the field till it is cleared. Another method is, to pull up such a quantity of turnips as they can consume in one day, when they are successively admitted into the various inclosures: this is more advantageous than either of the former modes, as a piece of land, contiguous to the turnip field, may thus be manured without the expense of carting manure thither. But we conceive the most economical management will be to give the cut or steamed roots at home, by means of the troughs and other contrivances mentioned in a subsequent page; and, when combined with a few bushels of peas, or a proportionate allowance of good hay, they will afford additional nourishment, and render the animals uncommonly fat. Further, sheep will eat parsley with great avidity, which imparts to their flesh a peculiarly delicate flavour; that vegetable, however, is rather to be considered as *medicinal*, than as an article of food, it being found very serviceable to such animals as are *scabby*, *dropsical*, or *disposed to rot*.

In the preceding paragraph, *turnips* chiefly have been adverted to, as affording a wholesome food for sheep; but other roots may be advantageously employed for the same purpose, as the subsequent detail of experiments will evince. They were

made by M. Cretté de Palluel, and by him communicated to the Royal Society of Agriculture of Paris, in 1789.* He states, that the practice of feeding sheep in houses was commonly adopted in many of the provinces of France, where they were fed with clean corn (i. e. barley and oats, sometimes grey peas, beans, and rye,) and sweet, fine hay; and that, when roots were given in lieu of corn, clover, rouen, or lucern hay was continued. Though the sheep thus fed on roots did not become so fat as those which were corn-fed, yet they all fattened: and he thinks they would have made greater progress, if their food had been varied. This opinion he supports by an experiment made on four, whose food was changed, and the animals ate considerably more. The sheep which were put on potatoes, were for a few days somewhat averse to them, and at first ate but little; consequently they did not thrive so fast; though they recovered in the second month what they lost in the first. Those which were fed on turnips and beets, ate heartily of them from the beginning, and continued so to do. They all drank much less than those which were corn-fed.—M. de Palluel thinks that corn might be advantageously added to the roots; and, when the sheep are destined for sale, if two feeds of corn be given them for a fortnight, in the intervals between their meals of roots, this would give a degree of firmness both to their flesh and tallow.

A very valuable addition to the articles of sheep-food has been made by employing muscovado sugar. Under the direction of the Board of Agriculture, a series of experiments was undertaken by the Rev. Dr. Cartwright, in order to ascertain the daily quantity of brown muscovado sugar necessary to fatten sheep, to show its effects and value when so applied, and to demonstrate what substance sufficiently cheap might be mixed with it, so as to prevent its application to common uses, and yet render it not unpalatable or pernicious to animals feeding upon them. It should be stated, that these experiments originated in a suggestion of the Parliamentary Distillery Committee of 1808, that the drawback on sugar should be allowed to the farmer for agricultural purposes, on his mixing it with some substance, which would render it unfit for com-

* This interesting account is abridged from the "*Mémoires de l'Académie Royale d'Agriculture*," of Paris, for the year 1789.

mon uses, in the presence of an excise officer. This suggestion was not embodied into legislative enactment: but Dr. Cartwright availed himself of a short interval of leisure, in order to ascertain how far the proposition might be practicable. The following is an abstract of his extensive detail addressed to the Board of Agriculture:

The flock of sheep purchased for the purpose of instituting a set of experiments to ascertain the facts enumerated in the title of the paper, consisted of fifteen two-shear Down wethers, which were bought at Chichester, 24th August, 1808; they were bred upon the Downs, and had been folded through the summer, and were in a common store state. They were weighed on the 27th August, and their average weight was 90½lbs., and the price was 35s. per head. For the first week they were folded every evening, and had half a pint of bran and a quarter of a pint of pease each; and the same was given them when they left the fold in the morning. In a week they became habituated to dry food, and then to this quantity of bran and pease was added an ounce of sugar for each; and when they were familiarized to this, the next object of Dr. Cartwright was to try what different substances might be given in addition to the sugar, which would not be injurious to them, and which they would not reject, and which at the same time would spoil the sugar for all other purposes; and he thought it better to try the experiment with the different substances, while the sheep had access to the grass field, rather than wait till they were kept upon artificial food altogether.

The substances used for this purpose were, linseed-oil, train-oil, palm-oil, oil of hartshorn, assafœtida, urine, antimony, and charcoal; most of them preventing the sugar from being used in distillation, and all of them spoiling it for common purposes. Linseed-oil was first tried, in the proportion of one to thirty-two parts of sugar, and the mixture was given for the first time on the 7th September, and was put into one only of the three troughs out of which they fed; the sheep, however, eat indiscriminately, and apparently with the same appetite, the mixture which contained the linseed-oil, as those which had the sugar only; on the following day the quantity of oil was doubled, and the sheep continued to feed upon it with the same appetite. After this, train-oil was given in the same proportions, and with the same success; and it was supposed, from

the particular avidity with which they devoured this mess, that the train-oil so far from rendering the sugar less palatable to them, gave it a more agreeable zest and poignancy. The next experiment was with assafoetida, in the proportion of one to four hundred and forty-eight parts of sugar: part of the sheep began upon this mixture immediately, but others hesitated, and when they did feed, it was somewhat fastidiously, and the troughs were not emptied quite so clean as before; this experiment was suspended at that time, and a trial made of a mixture of sugar with urine, in the proportion of one part sugar to twenty-four of urine; but an obstacle, from swarms of bees devouring the mixture as soon as put into the troughs, prevented the experiment from being carried on at the usual hour, and the mixture was obliged to be given to the sheep in the evening instead of the morning; they were, however, no sooner accustomed to the change of time, than they fed upon it as greedily as upon the other mixtures, and there was no reason to conclude that the urine had any influence in abating their appetites, or was in any degree offensive to them. The experiment next in succession was with palm-oil, which appeared very likely to answer the purpose of the experiment; and as far as the sheep were concerned, it fully justified the expectation; for they did not seem conscious that any variation had been made in their usual repast. The experiment with assafoetida was then renewed, and the sheep fed on this as readily as on the other mixtures; it was given in the proportion of one part to two hundred of sugar. The next experiment was with the empyreumatic oil of hartshorn, a substance uncommonly offensive to the smell; but even this was not rejected by more than two or three sheep, and not by them for more than a day or two; the proportion of it was one in two hundred and twenty of sugar. Tartar emetic, in the proportion of two hundred and forty of sugar, was afterwards given, and produced no ill effect on the bowels of the animals. Dr. Cartwright being convinced, from these experiments, that of the substances recommended for the purpose unfit for common uses, and of which he had made the trial, there was none which sheep would reject when mixed with sugar, in proportions sufficient to answer the end proposed, thought it might be also satisfactory to the Board to know in what larger proportions the oils might be given before the sheep would betray symptoms of disgust. Linseed-

oil, train-oil, and palm-oil, were given in the proportion of one to eight, and the allowance of sugar at the same time increased to two ounces each per day; and these mixtures appeared to be equally as palatable to the sheep, as any thing which had been administered, and produced the same results, and without producing any change in the state of the bowels.

On the 29th of September the sheep were again weighed, and their average weight was nearly 109lb. each, being an increase of upwards of one-fifth of their original weight; and they were tolerably fat, though it was the opinion of the person who purchased them, that they would not make themselves fat on grass only before Christmas.

From the 24th September to the 22d October, their allowance of food was increased to a quart of bran per day, one pint of pease and three ounces of sugar, ringing changes at the same time with the different substances with which the sugar was debased, and this was done to discover the particular substance which they most relished; and though they appeared to be extremely fond of all, yet if a conjecture might be hazarded, the preference was in favour of train-oil. Dr. Cartwright, however, suggests (if the practice of using sugar in this way should be adopted,) that instead of employing any one of these articles singly, it would not be unadvisable to use a composition of several of them together, which would be attended with no additional expense; and he recommends, that instead of mixing, for example's sake, four pounds of palm-oil, with one hundred weight of sugar, that four pounds of a mixture were substituted, composed of palm-oil 1lb., train-oil 1lb., urine 2lb., emetic tartar 2oz., assafetida 24 grains, and oil of hartshorn 28 drops; since in this composition are comprised an animal, a vegetable, and an empyreumatic oil, a substance containing ammoniacal and other salts, metallic calx, and a resinous gum; and the whole expense of which would not exceed one shilling and eight-pence upon each hundred weight of sugar. And he is of opinion, that the most practicable way of managing this business, would be to have only one person or company in each sea-port, where sugar is imported from the West Indies, licensed to sell it in the adulterated state.

This detail of the experiments is thought by the author to have afforded a very satisfactory conclusion, that sugar thus adulterated may be advantageously given to sheep, and indeed

to other animals; for a horse was equally fond of it, and both sheep and horses are known to be delicate feeding animals compared with cattle.

On the 22d October, the sheep were again weighed, and were found to have gained an average increase of weight of 15lb. each since the 29th September; they were then taken into the house, and kept upon artificial food altogether; and one of them appearing to droop, that with two others were sent to the butcher, and the remaining twelve reserved for further experiments, and they had no sugar in their food for several days, that they might be reconciled to its omission, and might all start fair, and without any preference of means.

On the 2d November they were divided into three classes of four sheep each, and were weighed on the 12th, when a very inconsiderable gain was perceived, which was accounted for from their not being yet reconciled to confinement. An attempt was now made to adulterate their food with charcoal, but this part of the experiment was soon given up, from the difficulty of obtaining it sufficiently pulverized; bran, peas, and hay, were given to all, and to the first class six ounces of sugar each per day, to the second class four ounces each, and to the third class none. They were weighed every week, and the respective weights of each are given in Dr. Cartwright's original communication, but the increase of weight was not considerable, and sometimes one class and sometimes another had the superiority of increase; but their progress in confinement was not equal to that which was made when they were at liberty; and both those which had only four ounces of sugar per day, and those which had no sugar at all, made rather more progress than those who had a daily allowance of six ounces, and the advantage was rather in favour of those who had the four ounces of sugar per day.

From all the facts taken collectively, Dr. Cartwright draws the following conclusions: "1. That sugar may be given with great advantage to sheep, if not confined, especially if they have access to green food, however little that green food may be in quantity. 2. That sugar may be given to them with every prospect of a beneficial effect, in the quantity of four ounces per day to each sheep. 3. That sugar, supposing it to be purchased at four-pence per pound (which it might be if duty free), would at the rate of four ounces per day be paid for in a return of flesh, exclusive of the advantage of expeditious

feeding, and the benefit to be derived from the manure. 4. That six ounces per day to each sheep exceeds the maximum that can be given with the best advantage to sheep of the size of South Downs. 5. That the advantage of stall-feeding sheep altogether upon sugar and dry food, of whatever nature that food may be, is extremely problematical.*

On these ably-conducted experiments we have only to remark, that in our judgment, Dr. Cartwright has fully shown the practicability of feeding sheep at least, if not other cattle, with sugar; and that, in the event of any future glut in the sale of colonial produce, the farmer may beneficially avail himself of this article and relieve the sugar planters, without interfering in any degree with the distilleries. In the application, however, of sugar to this purpose, the caution given in page 148, relative to the mixing of dry fibrous matter with it, should most carefully be attended to.

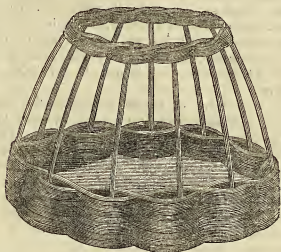
In France, the practice of sheltering their flocks at noon, during the summer, is universal. It is very refreshing to the sheep, and affords them protection from the flies. Where buildings are commodiously situated, this practice is certainly worthy of the attention of English breeders.

But the fattening of sheep cannot be conducted to advantage without regularity in distributing, and economy in the management of, the various articles that compose their food. Hence it will be necessary to have troughs, with partitions in the middle and racks annexed, about two feet high from the ground, the whole being firm and steady, so that it cannot be overturned. This contrivance is well calculated for use, whether at home or abroad, for the prevention of waste; with the same intention, the machine delineated in the annexed figure has been successfully employed in the county of Lincoln.

This contrivance is denominated a *tumbril*: it consists of a circular cage or crib, which may be made of osiers, willows, or other pliant brushwood. The whole is about ten feet in circumference, and closely wattled to the height of about one foot, above which it is left open for the space of eighteen inches; it is then wattled again to the height of eight or ten inches, and an opening about eighteen inches in breadth is left at the top for putting in the roots or other food, whether green

* Communication to the Board of Agriculture, Vol. vi. Part II.

or dry. The staves which form the skeleton of this utensil are ten inches asunder, so that twelve sheep may feed at the same time in each tumbil.*



Considerable benefit may be derived from the adoption of the simple contrivance above represented for the purpose of feeding sheep; for it not only effects a material reduction in the consumption and expense of provender, which is thus prevented from being trodden under foot, or soiled with dung; but also, in this state of separation, the stronger sheep cannot drive away the weaker, as each is secured by the head. Besides, as the construction of such a tumbil is attended with no difficulty, it may be easily procured, and conveyed to any part of the farm; and, with due care, may be kept in constant use for eight or ten years.

But whatever system of management may be adopted by the farmer, whether at home or in the field, he ought on no account to withhold salt from his live stock, especially from sheep; for not only does the continual use of that article contribute to the digestion of succulent vegetables, and of course preserve the animals in constant health, but it is also said to improve both the quantity and the quality of the wool. Hence, as it aug-

* "Repertory of Arts and Manufactures," Vol. IV. First Series.

ments the nourishment of the food eaten in proportion to the quantity of saline matter, it ought to be particularly used in those moist situations, the produce of which is liable to rot sheep, of which malady it is affirmed to be both a preventive and a cure. Rock-salt is undoubtedly preferable: but, where this cannot be conveniently procured, it will be advisable to dissolve common salt in water, and after mixing it with fine, pure clay, or with pulverized and sifted chalk, to form the whole into masses or lumps, which may be placed under shelter, so that the sheep may lick it at pleasure.

But the importance of salt in preserving the health of sheep is not generally known, or perceived, by many breeders even of this island, who do not give it in any form. The same prejudice exists in Prussia and Holland, where no salt is allowed to these animals, which, in so moist a country as that of Belgium, is rather singular. As far, however, as the use of salt, considered as a preventive of the rot, is concerned, the not giving it is compensated by the numerous alder-trees that grow in Holland, and which, we are informed by M. Twent, an experienced Dutch breeder, sheep eat with uncommon avidity in wet weather, and are thus preserved from the rot, even when they are suffered to pasture in marshy places.

On the contrary, at Rambouillet, in Silesia, Saxony, Sweden, and Spain, salt is considered as a most important article, and the use of it is most strongly recommended. In Sweden, they give salt, particularly in rainy or damp weather, and frequently add to it wormwood, or some other bitter vegetables, juniper seeds or berries, and even pitch. All these articles are reduced to powder, and, after being diluted with water, are carried to the stable or sheep-house, and put into the trunks of trees, which are excavated expressly for this purpose. At the circumference of the trunk are fastened three or four pieces of wood, which rise vertically about a foot and a half above the edges of the trunk, in order to keep the sheep from leaping over it, as well as to spread out or to salt their food. The preparation just stated is considered as an excellent preventive of several distempers, particularly the dropsy, to which the Swedish sheep are very liable.

The preceding statements have been given chiefly with reference to the fattening of sheep profitably for the market; but it ought never to be forgotten, that the growth of the wool is

liable to be materially affected by the system of feeding pursued. *It is essential to the evenness and strength of the staple, that the feeding of the animal should be uniform, without any sudden interruption or transition :* for, where this is suffered to take place, the natural progress of the wool is checked; a second growth succeeds; and the point of contact becomes so weak as to snap under the operation of the manufacturer; who, being aware of this disadvantage, cannot of course afford such a price for wool of this description, as he could for that of a more perfect staple. Much wool is injured in this way between summer and winter keep, which should be made to blend as gradually as possible, that the mischief above described might be prevented. A sudden transition from rich to poor diet, or from poor to rich keep, ought carefully to be avoided.

Before we close the present discussion respecting the management of sheep, it may not be improper to advert to one or two practices materially connected with them. The first is that of *docking*, or cutting their tails; which prevails not only in this country, but likewise in Spain, Saxony, and, generally speaking, in every district where the inhabitants pay much regard to the improvement of wool-bearing animals. The tails are usually cut when the lambs are three or four months old; as, if the operation were deferred beyond that time, it could not be performed with safety to the animal. But this practice is objected to by some intelligent breeders in England, on the ground that it renders sheep unable to defend themselves against the attacks of flies during hot seasons. By others, however, this practice is strongly recommended, because it tends to preserve the health of the animals, by keeping them more clean from the ordure which they, in a great measure, deposit on the fleece. The other practice above alluded to is, that of *extirpating the horns of sheep*; which has hitherto, we believe, been confined to the sheep-walks of Spain, and to the sheep-farm at Rambouillet, in the south of France. The reasons assigned for it, and the manner in which this operation is performed, are thus detailed by M. Lasteurie.*

“The horns, given by nature to the ram for self-defence, become not only useless, but also inconvenient and troublesome to him when domesticated; they prevent him from

* *Histoire de l'Introduction, &c.* p. 236.

pushing his head between the interstices of the rack, in order to cull the straw, of which he eats only the outer skin; and to select the ears and tender blades of grass that are mingled with it. They very frequently wound ewes when passing through gates; and not seldom do they prove fatal to the rams themselves, when these begin fighting. There are two ways of cutting off the horns, viz. by means of a saw, or with a chisel. In the former case, a very fine hand-saw is made use of; but the English hand-saws are most convenient for this operation. One man takes firm hold of the ram's head, a second performs the amputation, which requires only a very short space of time, if the operator is dexterous in the use of the saw.

"Amputation with the chisel, of which the Spaniards avail themselves, is by no means so simple. They dig a ditch, or trench, of the length and breadth of a sheep, and five or six inches deep; at one end of this a second ditch is dug; but not so broad as the first, with which it forms a cross. In this last ditch, which is very shallow, a plank is placed, that serves as a support for the head of the ram, which is thrown on his back into the trench that forms the cross. A man then lays himself flat on his belly over the ram, and with one hand forcibly presses the animal's head against the plank, while, with the other, he grasps a long and large chisel, of four or five pounds weight; this he fixes successively upon the horns, and on it another man strikes one or two hard blows with a wooden mallet, which very neatly takes off that part of the horn which is intended to be separated. The preparation required by this method, renders the use of the saw far preferable to it. This operation is usually performed at the end of the first year." And M. Lasteyrie remarks, that, "when the horns shoot forth again, it is not uncommon for them to touch some parts of the head, which they gall considerably, and into which they will sometimes enter deeply, unless they undergo a second amputation."

In fine, throughout the whole system of sheep husbandry, the greatest attention is necessary, on the part of the shepherd, regularly and frequently to inspect the animals committed to his charge;* and in order to facilitate this object, it has been re-

* In Saxony the shepherds have no fixed wages, but are allowed a profit on the produce of the flock. From the adoption of this arrangement, the sheep-masters derive great advantage, as the shepherds have no inducement

commended to have a moveable sheep-house in which to reside; thus, being always on the spot, he will be enabled to assist the sick or weaker animals, and will prevent many of those accidents which must otherwise unavoidably happen.

SECTION IV.

On the feeding and fattening of Swine.

WHEN permitted to wander abroad, at pleasure, swine devour in marshy and miry grounds (in which situations they delight to wallow), fern, frogs, sedge, &c.; but, in drier spots, they feed on sloes, crabs, hips, haws, chesnuts, acorns, beech-mast, and similar wild fruit. In the domestic management of these animals, however, the quality and supply of their food is regulated by the divisions into which they are classed, according to their age and other circumstances. In order, therefore, that the food may be expended to the most advantage, it will be advisable to distinguish these animals in the following manner: 1. Sows with Pig; 2. Pigs; 3. Store Pigs; and, 4. Fattening Hogs.

1. With regard to sows in pig, it is obvious that they should be better fed than either of the other classes, in order that they may be enabled to supply their young litter with the necessary supply of milk; but, while care is thus taken to keep them in good condition, equal caution is necessary that they be not too fat. Thus, for such as litter in the spring, tares and cabbages, combined with the waste milk and wash of the dairy, may be employed with advantage; or, if the supply from the dairy be not adequate to the demand, a wash may be prepared with oat, barley, or other meal. For those which litter in autumn, lettuces have been found very wholesome and nutritive, in addition to the wash; and in the winter season, potatoes, turnips, and other roots, previously prepared by boiling, should be added.

to deceive them, and are themselves interested in taking due care of the flock." *Laisleyrie*, p. 176.—How far this practice is feasible in England, it would be rash in us to assert; but, as the hint seems worthy of attention and of trial, we leave it to the consideration of the intelligent reader.

2. With regard to young pigs, where it is practicable, they may be fed in the same manner as sows, with the addition of oats and pea-soup, made by boiling a bushel and a half of peas in about sixty gallons of water till they are thoroughly broken and dissolved; this soup may then be mixed with the dairy wash; or, if given alone, it will, in the opinion of Mr. Young, wean them well. If any dry meat be given, he thinks oats are preferable to any other sort of corn, as barley is apt to disagree with them.*

An intelligent farmer in North Britain, who keeps from five to seven breeding swine, disposes of most of their produce, when from six weeks to three months old: considering this system fully as profitable as fattening them for sale. At these ages he generally has a good demand for them, as many people, such as tradesmen, villagers, &c. wish to fatten a pig or pigs, who could not conveniently keep a breeding sow. Having this advantage, there is scarcely a cottager, or weaver's family in the neighbourhood who have not their fat pig killed, after being fed on the refuse of their potatoes and the offals of their kitchen, to the weight of from eight to twelve stone.†

3. Store pigs are those which have attained nearly half their growth, and should be separated from others in the course of May, when they may be turned into the clover and cichory fields, the gates of which should be locked on them. Here they are to continue till Michaelmas; but in order that this system of management may be attended with due effect, it is necessary that all the fences be in excellent repair, and that there be a pond in the field to supply the animals with water. From such practice the most beneficial consequences must result, the farmer being thereby enabled to keep a larger number of swine, while the increased quantity of manure will amply compensate the expense attending it.‡

With all the advantages of the preceding system, Mr. Young prefers the soiling of swine in the yards, notwithstanding the expense is greatly increased, and some portion of food will be necessarily wasted. The proper vegetable crops for this pur-

* Farmer's Calendar, p. 22.

† Sir J. Sinclair's System of Husbandry pursued in Scotland, Vol. I. p. 149.

‡ Farmer's Calendar, p. 277.

pose are lucern, cichory, clover,* tares, and other green meat. But, in order to carry on this system with effect, he directs the hog-yards to have gates of sufficient width to admit carts for bringing in the food, as well as for removing the dung; nor should it be attempted, unless an ample supply of litter can be commanded, together with sand and peat, to be laid on the ground for the purpose of absorbing the urine. In addition to the articles above specified, we state on the authority of Dr. Pulteney, ("Transactions of the Linnæan Society," Vol. 5.) that the water-crowfoot, (*Ranunculus aquatilis*, L.) is not only relished by swine, but these animals likewise thrive so well on that vegetable, as to require no other food till they are put up to fatten. For the winter-keep of store swine the various roots are admirably calculated, such as turnips, potatoes, and the Jerusalem artichoke, which require to be boiled; Swedish turnips, carrots, root of scarcity, or *mangel-wurzel*, and parsnips, which may be given in a raw state; and to these may be added peas, beans, and cabbages. With regard to the soiling of pigs, Sir John Sinclair has noticed a discovery of considerable moment: it is, that they may be soiled on cut green beans with great profit, and that they are ravenously fond of these. The Windsor sort is preferred, and the beans should be planted at three different times for the sake of regular succession. The feeding may commence in the beginning of July, and terminate about the end of September. When pork is worth $7\frac{1}{2}d.$ per lb.; the profit, besides a quantity of most valuable manure, is calculated to be about 10*l.* per acre.†

4. The business of fattening hogs is generally performed in February or March, and in the month of October; for *pork*, they are usually fattened from six to nine months old: for *bacon*, from nine months to a year and a half; and store swine to the same period, or very rarely beyond two years. For porkers, butter-milk, whey, and pea-meal are preferable; for bacon hogs, equal parts of fresh pollard and pea-meal have been recommended; and it is a fact, that white peas are much better calculated than beans either for feeding or fattening swine, as these animals not only fatten more kindly when fed with the

* Where *cottagers* have gardens and keep pigs, it would be profitable if they had a small spot of clover in their gardens to cut for them.

† Sir J. Sinclair on Scottish Husbandry, Vol. II. p. 18.

first-mentioned pulse, but their flesh is also said to swell in boiling, and have a good flavour; while that of swine fattened on beans will shrink in the pot, the fat will boil out, and be less delicate in point of taste. Hence many farmers feed their hogs with pea and barley meal, and will frequently purchase peas when their own store is exhausted, rather than suffer the beasts to feed on beans; and some will even reject grey peas, as approaching too near to the nature of the bean, and making the meat tough and dry. The proportion of peas requisite to fatten a hog necessarily varies according to the size, breed, and kindliness of disposition to fatten; but forming an average judgment from the weight of the beast both before and after he is put up, Mr. Knight ("Communications to the Board of Agriculture," Vol. II.) is of opinion, that a hog in good condition when put up, will consume about six or seven Winchester bushels of peas; and states, that each bushel will increase his weight after the rate of nine or ten pounds; so that when the animal is fat, he will weigh twenty score.

The most profitable mode, in the estimation of Mr. Young, of converting any kind of corn into food for swine, consists in grinding it into meal, and mixing the latter with water, in cisterns, in the proportion of five bushels of meal to one hundred gallons of water; this must be well stirred several times in the day, for a fortnight, during warm weather, or for three weeks in a colder season; at the expiration of which time it will have fermented and become acid. In this state, and not before, the wash is ready for use: it ought to be stirred every time before feeding, and it will be necessary to keep two or three cisterns fermenting in succession, in order to prevent it being used before it is duly prepared. The difference of profit between feeding in this manner, and giving the grain whole, or only ground, Mr. Y. adds, is so great, that whoever tries it once, will not be induced to change it for the common methods. He further states, that pea soup is an excellent food for hogs; and, as far as he is capable of knowing, (for he admits that he has not sufficiently compared them), may be equal to the acid mixture above mentioned, especially if it be given during winter in a tepid or lukewarm state; but, in adopting this method, the additional expense of fuel and labour must be taken into consideration. The refuse, wash, or grains of distilleries, likewise furnish a wholesome and useful article in the

feeding and fattening of swine. The refuse of starch manufactories is likewise employed with great advantage for the same purpose, particularly in the county of Surrey, in which there are many considerable starch manufactories. In that which, a few years since, was in the occupation of Messrs. Watson and Weymouth, at Lambeth, we have been informed, that not less than *ten thousand* swine have been fattened and cured, for pork or bacon, in the course of one year.

For the general stock of hogs, during the month of October, and part of November, cabbages are of incomparable use. Swine, Mr. Y. observes, are at that period often very cheap: and in such case it is of material consequence, that the farmer be amply supplied with an article of food, by which means he can keep this stock for a better market; in fact, without a provision of cabbages, it will be impossible to keep large stocks of swine to the best advantage.

The duration of time which is requisite for fattening these animals may, upon an average, be computed at five or six weeks, or thence to two or three months; and this period will, in most cases, be found fully adequate for the purpose, though the length of time is necessarily regulated by their kindliness of disposition to take on fat, the relative goodness of their condition, when first put up to fatten, and various other circumstances which it is impossible to foretell with precision.

But, whatever system of fattening swine may be adopted, it is of essential consequence that they be kept warm and clean, especially in cold and damp weather, during the period of fattening; and that they also be supplied with abundance of litter, the cost of which will be amply repaid by the increased proportion of excellent dung thereby obtained. It has, indeed, been frequently asserted, that swine thrive better while fattening, if they be allowed to wallow, at home, in their own filth, and abroad in mud and wet, because they delight in this habit; and thence it is assumed as certain, that it tends to their advantage. Such an assertion, however, is rather the offspring of prejudice than the result of real experience; we know that animals, when oppressed with heat, will plunge into water in order to cool themselves; but it cannot be inferred from this circumstance, that it will be necessarily beneficial to them. Besides, as there is an analogy between the disorders of this part of the brute creation and those of the human race, as well as in the

causes whence they originate, we shall here only remark, that swine are liable to be affected by drinking too much cold water, or wallowing in miry and humid places when overheated, and refer the reader to the subsequent chapter, where the maladies incidental to these animals are discussed. In addition, therefore, to the remarks already given (p. 104, 105), relative to the structure and situation of the piggery, we shall here state, particularly with reference to its connexion with their fattening, that a hog-stie should be built with the advantage of running water, so as to admit sufficient for the swine to drink, if such a situation can be commanded; the floor, or ground, being laid upon a gentle declivity to carry off their urine.

Not only, however, should these animals be kept warm and dry while fattening, but they should also be confined, if possible, by themselves; or, at all events, there should be as small a number in the same stie, and as much out of the hearing of the cry or grunt of other hogs as possible; otherwise, upon their first confinement, they will pine and decrease in flesh, notwithstanding they have abundance of food given them. By this means they will both have more room, and also be enabled to take more frequent and uninterrupted repose, which greatly contributes to promote their fattening; beside which, all those inconveniences will be effectually obviated, which often occur from hogs becoming averse to some particular animal, whose death not unfrequently follows in such cases. *Regularity of feeding* should likewise be especially regarded, as it has great influence in facilitating or retarding the fattening of swine; hence it will be proper to give them a full allowance of food three or four times, or at certain other stated intervals, in the day, as convenience or other circumstances will allow. And, if any animal should have surfeited itself, (which is no unusual occurrence, where due regard is not bestowed on the point last stated) by eating too large a proportion of food, it will be advisable to give such beast about half an ounce of flour of sulphur in some wash, once or twice in the course of the day, for two or three successive days. By this simple remedy their palled appetite will be restored more effectually, than by administering antimony, or any other drug that has been recommended to use in fattening swine; for, however such articles may *possibly* have succeeded in a *few* instances, it is obvious that they cannot be generally employed with advantage, and may not unfrequently be productive of hurtful effects.

Having already stated (p. 89) a few data that will assist the breeder to form an estimate of the progress made by hogs in fattening, and of course the most proper time to dispose of them with benefit, we shall conclude this section with a few remarks on the best modes of converting their flesh into *bacon* and *pork*.

In Hampshire, Berkshire, and some of the adjoining counties, after a hog is killed, the first process is to *swale* him, or singe off the hairs, by kindling a straw fire round the dead animal. Next, he is cut into *flitches*, which are effectually rubbed with a mixture of saltpetre and common salt, and are laid in a trough; here they continue from three weeks to a month, in proportion to their size, and are frequently turned during that time. Thence they are taken out and suspended in the chimney, over a wood or turf fire, till they are perfectly dried. In the county of Kent they are dried before a slack fire, which operation requires a similar period of time with that required for salting; and, in each of the respective counties above mentioned, they are hung up, or deposited on racks, till they are wanted for domestic consumption.

Somersetshire or *Wiltshire* *bacon*, which is the most esteemed in England, is prepared and cured in the following manner:—When a hog is killed, the sides are laid in large wooden troughs, and sprinkled over with bay salt, after which they are left for twenty-four hours, in order to drain off the blood and superfluous juices. Next they are taken out and wiped thoroughly dry, and some fresh bay salt, previously heated in an iron frying-pan, is rubbed into the flesh till it has absorbed a sufficient quantity; this rubbing is continued for four successive days, during which the sides, or *flitches*, as they are usually called, are turned every other day. Where large hogs are killed, it becomes necessary to keep the *flitches* in brine for three weeks, and in the interval to turn them ten times, after which period they are taken out and dried in the common manner; in fact, unless they are thus treated, they cannot be preserved in a sweet state, nor will they be equal, in point of flavour, to *bacon* that is properly cured.

According to the two methods above detailed, the *bacon* is made without stripping off the hide or skin; in some counties there prevails a contrary practice, which has lately been recommended on the continent, as being preferable of the two, be-

cause it affords an opportunity of advantageously converting the skin into leather, while the meat is said to take salt and be cured equally well as in the former mode. This method, however, is not a very novel one; the hides of swine have long since been made into shoes in China, where all the shoes sold to Europeans are manufactured from hog leather, the hair being previously burnt off by means of a red-hot iron. Where the consumption of bacon is very rapid, the practice last mentioned may be adopted; but we know from experience, that bacon will, in a short time, become rusty, and consequently waste will more or less be incurred, unless it be cured with the rind or skin, and be preserved in a dry room.

The *hams* of hogs are likewise converted into a favourite, though not a very digestible, article of food. In the county of Westmoreland the following method prevails:—First, they are rubbed very hard, usually with bay salt, after which they are by some curers covered closely up, while others leave them on a stone bench for the purpose of draining off the brine. At the expiration of five days, this friction is repeated with equal vigour with bay salt, combined with somewhat more than one ounce of saltpetre to each ham. Next they are suffered to lie for about a week, either in hogsheads among the brine, or on stone benches, when they are hung up in the chimney to dry. In this last part of the process there is a difference of practice: by some they are suspended so that they shall be dried solely by the heat arising from the fire below, without being exposed at all to the smoke; by others they are hung up in the midst of the smoke, whether this arises from coals or peat. If not previously sold, they are suffered to continue there till the weather becomes warm; when they are packed up with straw or oatmeal seeds, and sent to the respective places of sale.

Another mode of curing or preserving the flesh of swine is, by salting it down for *pork*: the tedious and common process by which such pork is cured being sufficiently known, we shall state the following simple method, which has been employed on the continent with great success, and which is the more valuable as it may be advantageously applied to *mutton* and *beef*. First, let two ounces of saltpetre, one pound and a half of refined sugar, and four pounds of common salt be boiled in two

* Report of the Agriculture of Westmoreland, 8vo. Edit.

gallons of pure spring water, over a gentle fire, and the impurities, that may rise to the surface, be carefully skimmed off. When this brine is cold, it should be poured over the meat, so as to cover every part : for *young pork* this immersion should continue three or four days ; older pork will require one, two, or three days more, according to its age ; and such as is intended to be dried for hams, ought to remain in it a fortnight before it be suspended in the chimney. At the expiration of that time, the latter must be rubbed with pollard, and covered with paper bags, to prevent them from being *fly-blown*. It ought to be observed, that in warm weather the blood must be expressed from the meat, and this should be well rubbed with fine salt previously to pouring the liquor over it ; and though the preparation of such brine may, at first sight, appear more expensive than that prepared in the common way, yet we think it deserves a preference, as it may be used a *second time* with advantage, if it be boiled, and a proportionate addition be made of water, and the other ingredients above mentioned.

CHAP. IV.

DISEASES OF CATTLE.

THE brute creation are, in general, liable to fewer maladies or complaints than mankind ; and, as their diseases are less complicated, they are of course more easily to be relieved : yet, among the various phenomena in the history of man, it is not the least singular, that the treatment of sick cattle has hitherto been confined chiefly to the most illiterate and ignorant peasants—men equally unacquainted with comparative anatomy and with the relative powers of medicine. Hence many thousands of valuable beasts have necessarily perished for want of that assistance which attentive observation, aided by sedulous inquiries, might have remedied, if not altogether prevented, by an unremitting regard to cleanliness in every department connected with the rearing of cattle.

With animals, as with the human frame, the variations of the atmosphere have a material influence on health; hence, though the limits of the present work confine our discussions to the chief distempers affecting cattle in general, we trust it will not be altogether useless to premise a few hints, founded on experience, relative to the ascertainment of the different changes of the weather; more particularly as an occasional reference to these remarks may afford the farmer some guide in directing the diversified operations of the field.

Among the various phenomena which attentive observers have found to indicate approaching changes in the atmosphere, the following may be selected as affording the most certain signs.

I. *By animals.*—1. Previous to rain and wind, or stormy weather, *neat cattle* and *sheep* seem more than usually desirous of feeding in their pastures, and to leave them with reluctance. A similar change is announced by the uneasiness of *swine*, which grunt loudly, and retire to their sties; by *geese* and *ducks* washing themselves repeatedly and with little intermission, flying anxiously backwards and forwards; by *swallows* flying low and skimming along the surface of the water, twittering with more loudness than usual; and by *poultry* rolling much in dust and sand, or gravel. Wet and windy weather is likewise indicated by *dogs* becoming drowsy and stupid, and exhibiting an evident reluctance for food, except grass, (particularly the species denominated dog's-grass, or couch-grass); and by *cats* losing their vivacity, and remaining within doors. *Continued rain* is announced by *pigeons* returning slowly to their cotes; a change from cloudy or unsettled to greater wet, by *flies* stinging and swarming more than usual; and a sudden variation, accompanied with a storm, by *wild ducks*, *plovers*, *bustards*, and other *aquatic birds* withdrawing to the sea-coast, or to the marshes.

The contrary circumstances evince the longer or shorter continuance of fine weather; to which may be added, that *bees* flying abroad, and labouring with that industry which has become proverbial; *crows* croaking in the morning; the *robin* or *red-breast* singing early from the more elevated branches of trees; and *gnats* flying in a columnar form, within the rays of the setting sun, are all indications of fine or serene weather.

II. *From the appearance of the earth.* Thus moist stones and

dry soil prognosticate rain ; a continued fall of which may be expected, if the ground seem nearly dry, and the roads almost, if not wholly, free from mud ; as the contrary occurrences announce, that the evaporation of humidity has ceased, and consequently that fine weather is approaching.

III. *From the atmosphere.* If in the evening a white mist be spread over a meadow, contiguous to a river, it will be evaporated by the sun's rays on the following morning, and is an indication of fine weather throughout the day ; so in the morning, if a mist, which is impending over low lands, draw off towards those which are more elevated, it announces a fine day. The gradual diminution of clouds, till they can no longer be seen in the air, is a sign of fine weather ; so likewise does the continuance of abundant dew upon the grass after a serene day. The contrary events announce a change of weather, which may be more clearly known by the clouds gathering and lowering ; by the sky, after serene weather, becoming undulated as it were with small clouds. During winter, if the clouds appear not unlike fleeces, i. e. thick and close in the middle, and very white at the edges, the surrounding sky being remarkably blue, they indicate hail or snow, or cold, chilling showers of rain. Further, where the clouds appear moving in two opposite currents, and the lower current is wafted rapidly before the wind, it is a certain sign of rain ; and, if they occur during summer, or generally in hot weather, they announce thunderstorms. If the rays of the sun break through the clouds, and are visibly dazzling in the air, the latter is loaded with vapours that will speedily descend in showers of rain. Thunder is mostly preceded by hot, and followed by cold and drizzling, or showery weather. Frequent variations of the wind to the different points of the compass evince the speedy approach of rain, particularly if it *whistle* or *howl* in its course through the atmosphere. The west wind is usually damp, on account of the vast quantity of vapour it collects in its progress over the Atlantic Ocean ; the south wind, which blows from the torrid zone, is the warmest of the four ; as the north wind is the coldest ; while the east wind is the most dry ; but, if rain fall during the prevalence of an easterly wind, it may be expected to continue, with little intermission, for four-and-twenty hours.

IV. *From the seasons.*—1. A moist autumn, followed by a mild winter, is usually succeeded by a dry and cold spring, in

consequence of which vegetation is materially retarded : such a spring occurred in 1741.—2. Should the summer be unusually cold and wet, the ensuing winter may be expected to be extremely cold ; for the heat, or warmth of the ground will be dissipated, or carried off, in consequence of such unusual evaporation.—3. Very wet summers are mostly attended with an increased quantity of seed on the dog-rose and white-thorn bushes ; so that the uncommon fruitfulness of these shrubs may be regarded as a certain indication of an intensely-cold winter.—4. A severe winter is uniformly predicted by cranes and other birds of passage migrating early in autumn ; for these creatures never take their flight southwards until the cold season has commenced in the northern regions.—5. Should frequent showers fall in September, it seldom rains in May ; and the reverse. So there usually falls less rain in April than in October, in the proportion of one to two ; in March than in November, in the proportion of seven to twelve.—6. On the contrary, should the wind blow from the south-west, during either summer or autumn, and the air be uncommonly cold for those seasons, a profuse fall of rain may be speedily expected.—7. A kind of crisis takes place in the atmosphere after great storms, rains, or similar violent commotions of the clouds, so that they are for some months attended with a regular succession either of bad or of fair weather.—Lastly, a cold and rough autumn prognosticates an intense winter ; as the latter season, when rainy, is mostly succeeded by an unproductive year.

For the preceding remarks we are chiefly indebted to an interesting tract, (which in fact every farmer should possess), entitled "The Farmer's and Gardener's Directory, containing the most approved Rules and Directions for foretelling the Changes which take place in the Weather, &c." We shall conclude these hints respecting the atmosphere, with the following rules laid down by Mr. Kirwan, from observations which had been made in England, from A. D. 1677 to 1789, during a period of 112 years.*

1. When no storm has either preceded or followed the vernal equinox, the ensuing summer is in general dry, or at least so five times out of six.

* "Transactions of the Royal Irish Academy," Vol. V.

2. If a storm happen from an easterly point on the 19th, 20th, or 21st day of May, the succeeding summer will also be dry four times in five. A dry summer will likewise follow, if a storm arise in any point of the compass on the 25th, 26th, or 27th days of March.
3. Should there be a storm either at south-west, or west-south-west, on any day from the 19th to the 21st of March, the ensuing summer will be wet five times out of six.

In England, if the springs and winters be *dry*, they are generally *cold* : but if *moist* or *humid*, they are usually *warm* ; whereas, *dry summers* and *autumns* are mostly *hot* ; as, on the contrary, *moist summers* are *cold*. Thus, if the moisture or dryness of a particular season be ascertained, an idea may be formed with tolerable precision respecting its temperature, and the farmer, by attending to the various indications of the weather, will be enabled to provide accordingly for the exigencies of his cattle stock.

SECTION I.

DISEASES INCIDENT TO CATTLE IN GENERAL.

VARIOUS are the maladies, to which cattle are liable : and, though constant and careful examination of their health will greatly contribute to the prevention of diseases, yet it will frequently happen that they become sick, either from the effects of our variable climate, or from causes which all the vigilance of the farmer cannot possibly control. It would greatly swell the limits of the present work, were we to enumerate every malady incident to cattle : we shall therefore confine our attention to a few of those which are of most common occurrence, and for the rest can with confidence refer the farmer to Mr. Clater's useful work on the Diseases of Cattle—the result of forty years practice and experience. But it cannot be sufficiently impressed upon the owner of cattle, that in all sudden

cases, it will be his real interest promptly to call in the aid of some expert cattle-doctor.

1. *Colds* are frequent attendants in the rearing of numerous animals, and are too well known to require any minute description. In these affections, as in every other malady, prevention is preferable to cure; it will, therefore, be necessary to preserve cattle from undue exposure to sudden blasts of wind, particularly from the north-east. When they become confirmed, or settle on some internal part of the body, the affected cattle may be easily discovered by the hollowness of their flanks, the roughness of their coats, the running or weeping of their eyes, and the heat of their breath. Colds prevail chiefly in the brute creation, as among mankind, in those springs which follow mild winters: and as they become contagious if long neglected, the diseased beasts should be selected as early as possible, and conveyed to a warm shelter or stable. Here they must be supplied with wholesome food; and, if the feverish symptoms increase rapidly, it will be necessary to take about two quarts of blood from the animal, except in the case of milch-kine. A warm drink, consisting of one quart of ale, with ginger, and a small portion of laudanum infused in it, should be given the beast, and the dose be repeated at the expiration of six hours. The drink ought to consist of warm water, in which nitre is dissolved; and abundance of litter should be allowed. As the animal recovers, it must be gradually exposed to the air, till it becomes sufficiently hardy to be turned out among the herd.

2. The *Colic*, or *Gripes*, may be ascertained by the restlessness of the diseased animal, which rises up and lies down almost incessantly, continually striking its head and horns against any object that occurs. Young cattle are chiefly affected by the colic; which is attended either with a *scouring* or with *costiveness*, and which of course must be treated according to those two circumstances. In the former case, a warm draught should be given, consisting of one quart of ale mixed with a few drops of laudanum, and two or three ounces of oil of sweet almonds, or, which perhaps is preferable, with half a pint of olive oil, and sweetened with sugar. This draught is to be repeated at the end of twelve hours, or oftener, as the nature of the case may require. When the colic is accompanied with costiveness, the following purge should be given as early as possible: let four, five, or six drachms of fine Barbadoes aloes,

and half a pint of brandy, be mixed with two quarts of water-gruel, and be administered in a tepid, or lukewarm state. In both cases, great and speedy attention is necessary, to prevent inflammation of the intestines, which must otherwise prove fatal; the beasts should also be kept warm and dry, in order to promote perspiration.

3. *Foul*.—This disease affects the feet of cattle, chiefly in consequence of hard driving, where they travel through much dirt. The part affected must be cleansed by washing, in order to discharge the offensive matter contained in the clees, or claws; after which they should be dressed with a mild digestive ointment, and kept perfectly clean from all filth, or other extraneous articles. Sometimes, however, the foul becomes *horny*, in consequence of neglect, and, though no material discharge takes place, is yet very painful; such indurations may be discovered by pressure with the hand, and must be removed with the knife, attention being paid to the directions above stated.

4. *Hoven*.—No distemper is of more frequent occurrence among cattle than that of being swollen, that is *blown*, or *hoven*, as it is usually denominated by farmers. It is induced either by exposure to damp situations, by too sudden removal from an inferior to a rich pasture, or by their eating too eagerly of turnips, clover, or any other succulent food; thus the stomach is loaded with food, and the process of rumination, or chewing the cud, being prevented, the animal becomes swollen with confined air, which penetrates into the stomach and intestines. Its preventive is obvious, and consists simply in turning cattle into such rich pastures only when they are not pressed by hunger, so that their appetite may be soon gratified; or they should be gently driven about for a few hours, that the dew may not only have time to evaporate, but also the animals being thus suffered to graze a very short time at once, their stomachs will become gradually accustomed to it.

Various remedies have been tried and recommended for this malady, which, if not opportunely discovered, inevitably proves fatal. Of these, the most common is to make an incision with a pen-knife beneath the short ribs, when a quill, or small tube of ivory or smoothed elder, is introduced, in order to give vent to the confined air; the wound is then covered with adhesive plaster, to prevent it from being affected by the external cold, and thus the danger is in general quickly removed.

The method here noticed appears to be the result rather of absolute necessity than of mature thought, though sanctioned by custom; and, as it is liable to be attended with fatal consequences through the ignorance or inexpertness of the operator, it becomes necessary to resort to more easy remedies. Medicines indeed are seldom of any particular service, on account of the distance to which country people are often obliged to go in order to procure them; but the following recipe, (which we communicate from Mr. Young's "Annals of Agriculture," Vol. xxxiii.) being composed of simple, cheap, and common ingredients, promises to be useful. Let three quarters of a pint of olive oil, and one pint of melted butter, or hog's lard, be mixed together, and given the animal by means of a horn or bottle; if no favourable change be produced in a quarter of an hour, the same quantity may be repeated. This dose is calculated for neat cattle: for sheep, when hoven or blown, a wine-glass full and a half, or two glasses, will be sufficient to be given in like manner. And it is asserted in the communication above cited, that this remedy is a specific for the malady in question, effecting a cure within the short period of half an hour. Where, however, the pen-knife is resorted to, and necessity alone can justify it, *the incision ought to be made with a small pen-knife, very sharp at the point, with a sudden push, four inches from the hip-bone, and four inches from the edge of the loin.*

Various instruments have likewise been contrived, with the view of relieving hoven cattle, two of which merit to be particularly noticed. The first of these is a flexible, metallic tube, invented by the celebrated professor of anatomy at Edinburgh, Dr. Monro; by whom it was announced to the public in 1793. It consists of iron wire, about one-sixteenth of an inch in diameter, twisted round a polished iron rod three-eighths of an inch in diameter, in order to give it a cylindrical form; the wire, after being taken off, should be covered with soft, smooth leather. To the end of the tube, which is intended to be passed into the stomach, a brass pipe, two inches long, of the same size as, or rather larger than, the tube, is to be firmly connected; and, to prevent the tube from bending too much within the mouth or gullet, an iron wire, one-eighth of an inch in diameter, and of equal length with the tube, is placed within it, and withdrawn when such tube has entered the stomach.

Dr. Monro has found, that the distance from the fore teeth

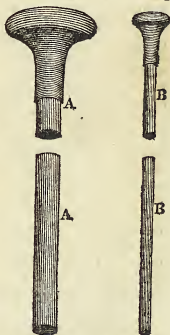
to the bottom of the first stomach of a large ox is about six feet; the tube ought, therefore, to be six feet, or two yards in length, in order that it may operate effectually with the largest oxen. When the tube has entered the stomach, it may continue there for any length of time, as it does not impede the respiration of the animal. The greater part of the confined air will be discharged through the instrument; and, in case it should be thought necessary, the remaining condensed air, or the superfluous moisture in the stomach, may be absorbed thence, by fixing a bellows to the upper end of the tube, with two valves, one at the muzzle, the other at the side of it, and so disposed as to allow the air to pass in the direction from the stomach upwards. At the same time, should it be deemed advisable to inject any ardent spirits, or other liquor calculated to check the fermentation, that operation may be performed with the utmost safety through this tube.

Equally useful with the flexible instrument of Professor Monro, is the instrument invented by Mr. Eager, for relieving hoven cattle and sheep; for which the Society for the Encouragement of Arts, &c. in 1796, voted to him a premium of fifty guineas, for communicating his simple and useful contrivance to the public.

The letters A A represent the knob of wood, and part of the cane to which it is attached, of a proper size for oxen, or other large cattle; the length of such cane should be six feet.

BB is the knob of wood, and part of the cane, calculated for sheep; its length ought to be three feet.

When any beast is swollen, or hoven, Mr. E. directs a person to lay hold of it by the nostril and one horn, while an assistant steadily holds the tongue with one hand, and with the other pushes the cane down the animal's



throat. Attention must, however, be paid, that the animal does not get the knob of the cane between his grinders, and that it be thrust to a sufficient depth, because its whole length will do no injury. As an obstacle will occur at the entrance of the paunch, the cane should be pushed with additional force; and, as soon as a fetid smell is observed to issue from that place, and the body of the beast sinks, the cure is performed, and nature will complete the rest.

Mr. Eager, in his communication to the respectable Society above mentioned, adverting to the cause of this disorder, attributes it to the superabundance of air introduced into the stomach by eating too large quantities of succulent food at one time, which occasions a more than usual portion of air to ascend from the paunch of the beast. This forces the broad leaves before the passage at the end of the stomach, as these leaves prevent the wind from passing upwards in its regular course. Consequently the paunch begins immediately to swell; the air becomes rarefied by the heat of the body, so rapidly as to impede the circulation of the blood; and the beast, whether ox, cow, bullock, or sheep, inevitably expires in half an hour, unless speedy relief be procured. It only remains to add, that Mr. Eager's plan and instruments have been sanctioned by the Earl of Egremont, as well as by several eminent farmers, who have attested their efficacy in relieving blown or hoven cattle.

Cheap and economical, however, as both these useful contrivances confessedly are, yet as *two* persons may not always be on the spot, to give relief to the animal, it becomes important to have recourse to other more portable and prompt mechanical assistance that may be given by one individual. For this purpose, Mr. Mason (of Goodrest Lodge, near Warwick,) in a communication to the Society for the Encouragement of Arts, &c.,* advises the use of the trocar and canula commonly employed by surgeons, for the relief of hoven cattle; and to penetrate with the trocar and canula through the beast's hide, to the paunch, on the near side, about six inches from the back-bone, at an equal distance from the last rib, and

* Transactions of the Society of Arts, &c. Vol. xxvi, pp. 128—131. For this communication, the Society presented Mr. Mason with their silver medal.

from the hip-bone. The trocar is then to be withdrawn, and the canula left in the wound, until the air has escaped from the paunch, when the canula may be taken out, and the wound covered with a plaster of common pitch, spread on brown paper, about the size of a crown piece. Mr. Mason states, that this operation is neither injurious to feeding oxen, nor even dangerous to cows in calf; and that it has been found particularly efficacious in preserving young calves when afflicted with this disorder, which proves fatal to numbers of them.

The very frequent occurrence of the disease now under notice, will justify the length at which we have treated its proposed remedies: on the efficacy of that suggested by Mr. Mason, no doubt, we think, can be entertained. Its superiority over other modes of treatment is very great, as it may be at all times applied with less risk than stabbing with a pen-knife, and certainly with less delay than waiting for assistance to apply the flexible tube. The size of the trocar also renders it a convenient instrument, to carry in the pocket at all times, when cattle are feeding upon clover; and the operation can scarcely be performed in such a manner even by the most ignorant servant, as to be attended with danger to the life of the animal.

4. *Looseness, or Scouring*, affects both oxen and cows, though its causes in both are different. In general, it arises either from want of sufficient food, both in quality and proportion; from being over-heated or over-worked; by feeding on wet, unwholesome fog, or after-grass; by not being lodged in dry situations; sometimes from giving them too large a quantity of cut hay or straw hotter than their natural temperature; though it is sometimes an hereditary taint, and in cows is caused by their taking cold while calving. But whatever be the cause, as soon as the scour or lax begins to appear, (and it may be easily known by their general debility and loss of flesh, the increasing paleness of their eyes, and irregular beating of the pulse, weakness of appetite, and frequent discharge of slimy excrement,) it will be necessary to house the beast, and put it to dry food; which, in early stages of the disease, will mostly effect a cure. Should the looseness increase, a pound of mutton suet, boiled in three quarts of milk, till the former is completely dissolved, may be given in a lukewarm state, which will contribute to allay the soreness necessarily occasioned by

the continual irritation of the abdominal vessels. Or, in cases of obstinate scouring, the following drink may be beneficially administered: let half a pound of grossly-pulverized tormentil root be boiled in two quarts of water, till this is reduced to one quart; strain it off, add a quart of red wine, a quarter of a pound of finely-powdered chalk or whiting, and two ounces of diascordium, without honey. This mixture should be preserved in a bottle, and well shaken together; it will be proper to make it lukewarm before it is given. The dose is half a pint, to be administered three times in the day, at nearly equidistant periods, till the beast recovers. Or, in similar cases, the following preparation may be given with equal, if not superior advantage: boil half a pound of pulverized common chalk in two quarts of water, till the latter is diminished to three pints: then add four ounces of hartshorn shavings, and one ounce of cassia, stirring the whole carefully. When the decoction is cold, two drachms of Thebaic tincture, or tincture of opium, and one pint of lime water are to be added; the whole should be kept closely stopped in a bottle, being well shaken before it is used: the dose is one or two hornsful, to be administered two or three times in the course of the day, as the nature of the case may require. But, where an hereditary *taint*, or *debility*, is the immediate cause of the scouring rot, as this malady is sometimes termed, it will baffle all the powers of medicine.

5. The *Pantas*, *Panting-evil*, or *Pantasie*, prevails chiefly during the intense heat of summer, though it is sometimes occasioned by sudden colds. It may be easily known by the panting, or heaving, of the animal's flanks, which is likewise accompanied by trembling and decay of flesh. In the treatment of this disease, it will be necessary to house the beast, and to give him every six hours (during the continuance of the chilly symptoms) one quart of warm strong beer, in which one table spoonful of laudanum, a similar quantity of ground or grated ginger, and two table-spoonsful of spirit of hartshorn have been previously infused. His food should consist chiefly of sweet, dry hay, with warm water, in which nitre may be dissolved, if a fever be approaching; and the animal should be well littered with abundance of straw. As he gains strength, he should be gradually accustomed to the air, and after a short time will be fully recovered.

6. *Poisons.*—While grazing abroad, cattle are subject to a variety of casualties or accidents, by eating the leaves of yew, various species of crowfoot, and other acid plants, as well as by bites from mad dogs, or other venomous animals. In the former case, the most effectual practice consists in drenching the animal with a mixture of equal parts of lukewarm salad oil and vinegar, afterwards giving a gentle purgative of Glauber's salt, or Socotrine aloes; and, if the viscera appear preternaturally distended with air, by administering a tepid infusion of tobacco in the form of a clyster, though the application of Dr. Monro's elastic tube, already described, p. 197, has in some cases been attended with success. With regard to bites of mad dogs, the only certain remedy is to eradicate the lacerated part, either by excision or by the actual cautery, the wound being kept open for a considerable time; but in cases of bites by serpents, vipers, or other venomous reptiles, we know of no better remedy than the continued and copious use of spirits of hartshorn, both as an application to the part affected, and also internally as a medicine.

7. *Red Water, or Bloody Urine.*—The name of this malady sufficiently indicates its nature, so as to render a specific description of it unnecessary; it may be easily discovered, in recent cases, by the animal's making frequent but fruitless attempts to discharge urine; but when they make much and frequent, with a considerable effusion of blood, it is a dangerous symptom. Cattle thus affected, usually leave the herd; extending their tails, they apparently feel pain in the urinary canals, and not unfrequently set their backs up higher than common.

The red water chiefly attacks young beasts; and is caused either by sudden changes of weather; eating acrid or prickly vegetables that puncture the smaller blood-vessels, and consequently produce the bloody discharge; by bad or coarse food; and likewise by bad or stagnant water.

As soon as a beast is discovered to void blood, it should be conducted to a warm, dry shelter, and kept on good hay, or similar dry food; formerly, and in many places the custom still prevails, it was the practice to drench the animal with a pound of Glauber's salts, repeating the dose on the following day. But such violent remedies are by no means calculated, in our opinion, to operate as a styptic, to prevent the discharge

of bloody urine; on the contrary, they rather tend to relax the animal, (already sufficiently weakened,) in a yet greater degree. We would, however, prefer a strong decoction of Peruvian bark, (for which oak bark may be substituted if necessary,) in which a small quantity of alum has previously been dissolved. The dose may be two or three hornsful, to be given twice or thrice in the day, at nearly equidistant periods, accordingly as the violence of the disease may require.

8. *The Staggers*.—This disorder is variously known by the names of the daisy, dizziness, epilepsy, lethargy, turning or vertigo, that sufficiently indicates its symptoms, the chief of which is a lethargic drowsiness, accompanied with a wavering, unsteady, and staggering gait. The seat of this malady is either in the *brain* or in the *stomach*; in the former case, it is usually produced by hydatids, or small transparent bladders filled with water, or by some other matters immediately acting upon the brain. Where this is the cause, medicine can afford no assistance whatever: but we remember an instance of epilepsy which occurred many years since, where this formidable disease was cured by the operation of *trepanning*, which was performed by Mr. Cheston, an expert surgeon, then residing at Gloucester.* But where the staggers is caused by plethora, or too much fulness of blood, bleeding, and cooling purgative medicines should be resorted to; and, as it is necessary to confine the beast in a warm stable or shelter, it will greatly contribute to promote the circulation, thus necessarily stagnated for want of exercise, by rubbing him every day with dry straw, and allowing him plenty of litter to promote perspiration.

9. *Wounds*.—Cattle, in general, are subject to a variety of accidents, which the limits of our work forbid us to specify, and which indeed are so numerous, that it is scarcely possible for human foresight to provide for every contingency. Hence our remarks will be confined to the most appropriate remedies for punctures, bruises, or common wounds.

In cases of common, fresh wounds, nothing is more necessary than to apply a salve, consisting of white lead, and oil of turpentine, incorporated together with a little brandy, to the lips of the cut, which should be drawn as closely together as

* For this interesting fact we are indebted to the excellent "Practical Essays" published in the year 1772, by Dr. Lyons, of Bath.

possible; and carefully to exclude the air. But if the laceration be deep, it must be washed with warm milk and water, and the ragged flesh, if any, cut out with a sharp knife; after which, the wound may be filled with lint or tow, dipped in the following digestive ointment, viz: Mix Venice turpentine and balsam of copaiba, or capivi, of each one ounce, with two ounces of yellow basilicon. The wound must, as in the former case, be kept from air and dirt, or its healing will be materially retarded.

The following remedy has been recommended as a certain styptic for fresh wounds: Bruise equal parts of stinging-nettles and salt in a mortar, till a pulp or mash is formed, and apply it to the wound; the bleeding of which, it is asserted, will *immediately* cease, however deep or dangerous such wounds may be. Not having had experience of its efficacy, we cannot vouch for its utility; but as the articles are always at hand, this specific, if such it be, certainly deserves a fair trial. Where, however, an animal has received any blows or bruises, without breaking the skin, it will be sufficient to bathe the part affected with camphorated spirit of wine; but if the swelling become inflamed, it will be requisite to make a slight incision below the contused spot, in order to promote suppuration, after which the following salve, or plaster, may be applied. Let frankincense and Venice turpentine, of each one ounce, be gradually incorporated over a slow fire, with two ounces of Burgundy pitch; and, when of a proper consistence, let a sufficient quantity be spread upon a pledget of tow or strong linen rag, and well fastened on with a bandage. As soon as the wound begins to discharge the matter freely, the digestive ointment and treatment just mentioned may be adopted. Lastly, should any swellings or local humours arise, without the beast receiving any external injury, or if the skin should be very slightly bruised, they will be effectually removed by supplying Goulard's mixture, which is prepared by adding two teaspoonsful of extract of lead, and one large spoonful of strong camphorated brandy, to one pint of water; the whole is to be well shaken together, and set apart for use.

DISEASES PECULIAR TO COWS.

10. *Cough*, or *Hoosing*.—This disease may be easily known, by the shortness of breath and difficult respiration that inva-

riably accompany it. Sometimes it arises from extraneous matters adhering to the throat, which, resisting the powers of mastication, produce an unusual tickling in that part; but more commonly it originates from cows taking cold while calving. A regular supply of sweet, succulent food, together with warm housing, (especially during the winter), is the only certain remedy that can be depended upon in this case; though some have recommended one ounce of pulverized aniseed, a similar quantity of tar, and of vinegar of squills, to be infused in a quart of warm ale, sweetened with honey. With this liquor the animal must be drenched every day for several weeks, otherwise no beneficial effects can be expected to be derived from such treatment.

11. The *Puerperal*, or *Milk Fever*, is chiefly occasioned by cows taking cold while calving. Hence it becomes particularly necessary to watch them when near their time of calving, as many valuable beasts are lost for want of due attention to this circumstance. Cows thus affected should be taken into the house, their heads being placed highest, in order that the natural discharges may take place without inconvenience. They should be allowed plenty of dry litter, and in other respects generally treated as in the case of violent colds, (which have already been discussed, p. 194), excepting that no blood must, on any account, be drawn, unless in cases of extreme necessity.

12. *Affections of the Udder*.—The udders of young cows, that are in high condition, are sometimes greatly swollen and inflamed for several days before they calve, in which case it will be proper to milk them repeatedly, and alternately to anoint the distended udders with cooling ointment and brandy. Beside these swellings, the udders of cows are liable to injuries, which are often of serious consequences, by falls, blows, wounds from sharp or pointed instruments, by the violent sucking of calves, and also from the injudicious or rough treatment of harsh or inexperienced milkers. While the inflammation remains in an indolent state, the parts affected ought to be repeatedly anointed in the course of the day with fresh butter, or with a salve, consisting of one ounce of Castile soap dissolved in one pint and a half of new milk over a moderate fire, constantly stirring it till it be thoroughly incorporated. An ointment, prepared from the juice of the leaves of the common thorn-

apple (*Datura Stramonium* of Linnæus), mixed with hog's lard, is likewise said to be an excellent application for swollen udders; or, the tumour may be anointed with a little mixture, consisting of camphor and blue ointment, about half a drachm of calomel being given in a hornful of warm beer, for three or four mornings, if the malady continue to increase. Where, however, the udder and teats are considerably inflamed, internal remedies should be resorted to: for this purpose it has been recommended to mix four ounces of nitre with one pound of common salt, and to give two table-spoonsful of the powder in a gallon of thin water-gruel every three hours.

But in case the disorder should, from neglect, have made such progress as to exhibit hard tumours, the following fomentations may be applied: let one handful of common hemlock (*Conium Maculatum*, L.) a similar quantity of the dwarf or round-leaved mallow (*Malva rotundifolia*, L.), and the same portion of common melilot (*Trifolium melilotus officinalis*, L.), be boiled in a sufficient quantity of water, and diligently applied, as warm as the beast can bear it. As soon as the tumour opens, let the sore be properly cleansed, and then cover it with a plaster of Turner's cerate, or of Basilicon ointment. The annexed remedy has also been successfully employed in obstinate cases of ulcerated udders, viz. Take gum ammoniac and gum galbanum, Castile soap, and extract of hemlock, of each one ounce; form them into eight boluses, one of which should be given every morning and evening.

Lastly, where the teats only are sore, they may be washed with clean, warm soap-suds, and rubbed with an ointment consisting of pulverized ceruse, or white lead, that has previously been saturated with brandy, mixed with a sufficient quantity of goose grease, or elder ointment.

DISEASES PECULIAR TO OXEN.

Oxen are subject to few maladies, exclusive of those incident to neat cattle in general, unless the effects produced in these animals by the ox-fly, breeze, or gad-fly, as it is variously termed, (the *Oestrus bovis* of Linnæus). This insect has spotted wings, and a yellow breast; it is furnished with a long proboscis, armed with a sharp dart, inclosing two others within it. The gad-fly particularly infects oxen, in the backs of which these

insects deposit their eggs, and in which the maggots are nourished during the month of June: throughout the summer they plague the cattle by means of their darts to such a degree, that they are often induced to rush into the water for relief, till the approach of night. It has been suggested, that the production of these terrible insects might be greatly checked, if not prevented, by washing oxen and cows, (which are sometimes attacked by these vermin) in the spring, with a decoction of tobacco, or any other bitter and acrid vegetable.

Such are the diseases incident to cattle, that are of most ordinary occurrence: for an account of the more dangerous maladies of inflammations of the liver and lungs, locked jaw, yellows or jaundice, &c., we beg to refer our readers to Mr. Clater's work, above noticed.

SECTION II.

DISEASES OF CALVES.

1. The *Cords*.—This disease is chiefly prevalent in Scotland, where it attacks calves during the first days or weeks after they are produced, and proves particularly fatal to such as are fed by hand and confined; though, if they outlive five or six weeks, they are seldom in any danger. The disorder appears to be of a plethoric and inflammatory nature, as the calves that die in consequence of it are extremely red; and the small leaders, or ligaments, are much contracted, whence probably the disease has its name. With the view to prevent the occurrence of the cords, it has been recommended to purge off the meconium, or first excrement, by giving the calf a little of the mother's milk, lukewarm, as early as possible, care being taken that no cold milk be given the animal for the first six weeks. And, in order to counteract or reduce such plethora, it will be advisable to turn them out every day for a few hours, as soon as possible after they are calved, in order that they may enjoy the benefit of full and free exercise in the open air; but where the weather or other circumstances may not allow this always to be done, (and especially as confinement is necessary to their speedy fattening), the most effectual preventive of this mortality, will be frequently to take a little blood from them.

2. *Cough*.—Where calves are exposed at too early an age to all the vicissitudes of the weather, before they acquire sufficient strength to undergo the changes of this climate, they are liable to take frequent colds: the consequence of which is a *cough*, that often proves fatal if it be neglected. For curing this malady, it has been recommended to pour half a table-spoonful of spirit of turpentine into the calf's nostrils, which must be held upwards, in order that the turpentine may flow into the throat: at the same time, the nose should be smeared with tar, and the animal kept within doors for a few hours, repeating this treatment as often as the cough is troublesome.

3. The *Gut-tic*, chiefly prevails in the county of Hereford, where it is considered as the effect of an enormous method of castration which causes a stoppage in the bowels, and brings on a mortification that speedily proves fatal. The symptoms are a total stoppage in the bowels, except a copious discharge of blood and mucus, accompanied by a violent fever, which occasions the calf to kick at its belly, lie down and groan. The gut-tie mostly affects calves, though they may live to be full aged, and yet be liable to a sudden attack of this distemper. The manner in which a cure is effected in the county above mentioned is, to make a perpendicular incision four inches under the third vertebræ of the loins, over the paunch, or stomach, and to introduce the arm, in order to discover the part affected, the beast being kept, if possible, in an erect position by the help of proper assistance. In order to remove the stoppage of the stomach occasioned by the *gut-tie*, and to carry off the fever, one ounce of senna, two ounces of cream of tartar, and four ounces of Glauber's salts, infused in two pints of boiling water, are given, with the addition of half a pound or pint of salad oil, the whole being worked off with gruel, in which mallows and alder bark have been infused.

4. *Scouring*, or *Looseness*, is generally the first malady that attacks calves; it is mostly, if not entirely, occasioned by the inattention of the persons to whose care the sucklings are committed; and who often put them too soon to suck, allowing them to remain longer at the teat than is proper: too frequent change of milk will likewise produce this disease. As soon as the looseness is discovered, it has been recommended to stint the calf in its diet, and to give an egg, boiled hard and chopped small, by drenching, fasting; the use of

which, once or twice, is asserted in most cases to effect a cure. And in the "Annals of Agriculture," Vol. xix. a correspondent recommends a mixture of pulverized chalk and wheat-meal, made into balls with gin, as a medicine which may be administered with safety.

5. The *Shoote* is a most fatal malady to calves, which it generally attacks a few days after birth. The usual symptoms are, first, a colic that is more or less violent, and is frequently very severe and dangerous, especially when it is contagious. This colic is terminated, and the calf relieved by a discharge taking place from the bowels; though this sometimes proves fatal before the *shoote* appears. Secondly, a loathing and refusing of food, even previous to the discharge, which decreases and increases according to the duration and violence of the disorder. Where the *shoote* prevails, the cheapest, and perhaps the best medicine which has been generally administered by experienced breeders is, eggs and flour properly mixed with oil, melted butter, and aniseed, linseed, or similar mucilaginous vegetables; or, simply, milk well mulled with eggs, may be given to the distempered animal.

SECTION III.

DISEASES OF SHEEP.

SHEEP are subject to various disorders, of which, however, our limits allow us only to state those of most frequent occurrence; hence we shall, for the present, briefly remark, that it may be easily ascertained whether these animals are in health, or diseased, by their agility and briskness; the clearness of their eyes, which, as well as their noses, are perfectly dry; by the sweetness of their breath; the coolness of their feet; regularity of perspiration; the fine red colour of their skin; soundness and firmness of their teeth; and by the uniform, unbroken texture of their wool.

1. *Blindness*.—This affection of the eye is produced by exposure to cold, particularly in too moist or too elevated situations; and is occasioned by long continued fatigue, which will

produce it, at any season of the year. It prevails chiefly in Scotland, where a cure is sometimes attempted ("Agricultural Report of the County of Perth," 8vo. ed.), by opening the angular vein of the eye, and holding the animal's head in an inverted position, so that some drops of blood may fall into the eye. This moderates the increased action of the vessels of that part, which is the immediate cause of inflammation; and also the blood, being so admitted into the creature's eye, will, in consequence of its mildness and warmth, produce emollient effects, which likewise contribute to promote a cure. This operation completely removes the white specks on the eye, and restores the sight; though some for this purpose pulverize a small quantity of glass, and blow it into the eye by means of a quill, open at both ends, which, by its friction, wears off such specks or scales. - "But the enjoyment of ease will infallibly cure them in a space of time proportioned to the fatigue they underwent before."*

2. The *Blood* is a fatal malady to sheep, which often die suddenly in consequence of it: in less violent attacks the symptoms are, panting and heaving of the flanks, and standing still. It is produced by feeding on too succulent or moist pastures. The most effectual remedy is bleeding; after which the animal should be turned into a dry pasture, and a mixture of common salt and nitre with bran may be given to it.

3. *Dunt*.—This disease is variously known by the names of staggers, giddy, vertigo, turn, sturdy, and bladder on the brain. It is occasioned by a vesicular collection of water in the head between the *dura* and *pia mater*, and uniformly produces a continual giddiness. The violently pulling of sheep by the ears, which are afterwards cut off, is said to have effected a cure: but the most frequent remedy is that of *trepanning*; a hazardous operation, which can only prove successful in the hands of skilful persons. In Saxony, several of the sheep-owners keep their lambs in the folds during their first year; having remarked, that such as are kept from the fields during that time, are very rarely attacked with this disorder. In Prussia, M. Lasteyrie states, that he had been assured, by many agriculturists, that they had secured their flocks from the turn, by fastening a linen cloth covered with pitch on the heads of the lambs, previously to conducting them into the fields. This kind of cap,

* Hogg's "Shepherd's Guide," p. 118. 1807.

they maintain, prevents the intromission of the worm which the flies deposit in the frontal sinus, during the earliest youth of the animals. A fact so important as this certainly deserves to be positively ascertained; we have, therefore, stated it for the consideration of our readers.

4. The *Flux* is a diarrhœa, or looseness, that attacks sheep which suddenly come to full feed, after having been stinted with food; though it is sometimes by their eating the plant known by the names of may-weed, mathen, or fetid chamomile (*Anthemis cotula* of Linnæus). In general, the flux is not attended with any dangerous consequences, and usually disappears in the course of a few days, in dry weather. Should it, however, continue longer than a week, it will be proper to give them some well-dried, sweet hay, and a decoction of clover flowers, with the addition of a little barley meal; allowing them neither any salt, nor to feed on any saline plants near the coast. But it is evidently the farmer's interest to give these useful animals a regular supply of food, as the weakness occasioned by the flux must necessarily reduce their condition.

5. The *Fly*.—This disorder is chiefly confined to sheep that are continually exposed in hot seasons, particularly in inclosed woody districts. The insects from which the disease derives its name, live among the wool, where they materially prevent sheep from thriving, from the severity with which they bite. Hence various remedies have been suggested, most of which, however, are in some degree injurious to the wool. Flour of sulphur, mixed up with butter, lard, or other unctuous substances, and rubbed in with the hand, have been found least hurtful to the quality of the wool; and the remedy, suggested by Sir Joseph Banks for the *scab* in sheep,* may be applied in the present case. When, however, maggots are formed, they should be carefully scraped from the wound, to which turpentine and brandy, mixed together, may be applied. Mr. Marshall ("Rural Economy of the Midland Counties,") directs such maggots to be picked out with a knife, or otherwise removed, without breaking the coat, when a quantity of white lead is to be scraped among the wool, which being agitated, the powder is carried evenly down to the sore. But due attention must be given, that too much ceruse be not applied, as it will discolour the wool; while a small quantity prevents any farther injury

* See it described, in page 226.

from the maggots remaining among it, as it drives them away from the wound, the healing of which it promotes at the same time. Mr. Preist, an intelligent chemist of Norwich, has prepared a cheap liquid, that not only cures where the fly has already struck, but also prevents its future attacks. It has been very extensively and successfully used by the Norfolk sheep-farmers.

6. The *Foot-halt*, as its name announces, is peculiar to the feet of sheep. It is occasioned by an insect resembling a worm, two, three, and sometimes four inches long. It is indicated by lameness, which often increases to such a degree as to prevent the animal from grazing. From pain and want of food the sheep languishes, till at length it falls a victim to the disorder, unless the worm be opportunely extracted.

As soon, therefore, as a sheep is observed to limp, the lame foot ought to be examined between the close of the claws, where the skin is found perforated, through which the worm has worked its passage upwards, between the external membranes and the bone. In order to extract the insect, it will be sufficient to move the claws in contrary directions, backwards and forwards, till the worm gradually makes its way to the surface. This simple expedient is far preferable to the operation of drawing out the insect, as in the last case there is always danger of its breaking off, and rotting in the leg of the sheep, the value of which will thus be materially injured. As the foot-halt occurs more frequently in wet than in dry seasons, and generally in the spring and fall, but rarely in summer and winter, it may be prevented, in most cases, by pasturing sheep in dry and healthy grounds, rather than in low meadows or marshy soils.

7. The *Foot-rot* is another disease peculiar to the feet of sheep, and if it be not quickly eradicated, generally proves contagious. It arises, in general, from sheep feeding on long, rank grass, in wet seasons; but inattention to cleanliness will also produce the foot-rot as well as the foot-halt.

This disease is known by lameness, which increases as the foot-rot becomes more inveterate, by the oozing of a disagreeably fetid matter from between the claws, and by the appearance of proud flesh in the more advanced state of the malady; at length, if it be not timely discovered, the foot becomes so completely mortified by the cancerous humour

corroding every part of it, as to become incurable, in which case the skin is the only valuable part of the animal. It is remarkable throughout the progress of this disease, that sheep retain their appetite, and apparently feed as well as when in perfect health; though they very soon fall away, and continue declining till they have lost all their fat. Their appetite, however, remains till the very last stage; and instances have occurred in which they have been so eager as even to crawl on their knees for food.

Various remedies have been tried and recommended for the cure of this contagious disorder, of which the following appear most deserving of notice. As soon as the disease is discovered, the sheep should be separated from the rest of the flock, and the part affected pared and cleansed, so as not to touch the quick, and at the same time to remove the gravel, if any should be there contained; after which either of the remedies subjoined may be applied.—1. Mix four ounces of the best honey, two ounces of pulverized burnt alum, and half a pound of powdered Armenian bole, in such a quantity of train or other fish oil as will make the various ingredients of the consistence of salve. The honey should be first dissolved gradually, and the bole carefully stirred in, and then the alum and oil are to be added.—Or, 2. Reduce three ounces of verdigris, four ounces of alum, a similar quantity of vitriol, one ounce and a half of white mercury, and one ounce of white copperas, respectively into fine powder, and gradually dissolve the whole into one quart of white-wine vinegar. It may be proper to observe, that the former remedy was invented by Mr. George Culley, an eminent grazier, of Fenton, in the county of Northumberland; and the latter by the late eminent Mr. Bakewell. In Mr. Young's opinion, ("Annals of Agriculture," Vol. xxi.) the salve is more efficacious than the liquid, having in one or two cases effected a cure where the latter had failed; But Mr. Y. states, that he uniformly employs Mr. Bakewell's remedy before the animals are anointed with Mr. Culley's salve.—Or, 3. Two ounces of roche-alum, a similar quantity of blue vitriol, one ounce of verdigris, and a quarter of an ounce of animated quicksilver, may be dissolved in a quart of good distilled vinegar; and this liquid may be dropped on the diseased part, care being taken to keep the feet dry, and clean from all dirt or filth.—Or, 4. When a sheep is first observed to be

affected by it, let it be brought in, and the sore foot well washed with soap and urine; then well bathed with turpentine, and afterwards rubbed all over with tar, and bound up with flannel: and if the sheep be then turned into a clean dry pasture, the cure is certain.*

In some observations on the nature and cure of this malady, communicated to the Board of Agriculture by R. Worthington, Esq. of Southend, the fact of its being contagious is clearly established; and the following method of treatment is stated to be that which has proved most successful. It consists, first, in perfectly cleansing the feet with soap and water; then, in scraping with a knife, and occasionally cutting off the foul and putrid portion of the foot, whether of the interior softer parts, or of the hoof. After this, the bloody surfaces are to be scoured with a mixture consisting of equal parts of muriate of antimony, tincture of benzoin, and tincture of myrrh; and a little muriate of antimony alone is directed to be applied with a hair pencil to the more ragged and diseased parts. To the practice of muffling the feet, in order to keep them dry, Mr. W. objects most decidedly; because, if the land be wet, when the sheep are turned out, the feet will suffer more from absorbed damp, than if they were not covered at all. He considers it preferable to give them food and lodging under an appropriate shed, or in some convenient out-house; and, at all events, directs that they should be kept on some dry treading, for an hour or two, after every dressing. The practice here described, Mr. W. asserts, will always put a stop to the progress of the foot-rot.† The following mode of treating this troublesome malady was communicated to the Society of Arts by Mr. Richard Parkinson of Walworth, who was honoured with their silver medal for it. In sheep thus affected, he directs the hoofs to be pared, leaving no hollow to hold dirt: if matter be formed, it must be carefully discharged, after which the feet must be washed clean from dirt with some stale urine, and wiped with a sponge. The sheep are next to be put into a house or shed, the floor of which has been previously spread, about two inches thick, with quick-lime reduced to powder by a small quantity of water. The fresher the lime is, the better. Upon

* Hogg's "Shepherd's Guide," p. 170.

† Communication to the Board of Agriculture, Vol. vii. Part i.

this, the sheep are to stand for six or seven hours, and the cure will be effected.*

8. *Gall*, or *Scower*.—This disease prevails chiefly during winter, and is supposed to be produced by severe frosts. An immediate change to dry food is the best remedy that can be resorted to; and it appears from the practice of Mr. Ellman, that if some hay be given to sheep on those mornings when hoar frosts are upon the ground, it prevents them from being attacked by the gall.

9. *Hoven* or *Blown*. See pages 195-199—*supra*.

10. The *Hunger-rot*, is generally occasioned by poor living, especially from a scanty supply of winter fodder. It may easily be known by the leanness of the sheep. An immediate change of keep is the proper cure.

11. *Pelt-rot*.—In this disorder the wool or hair falls off spontaneously from the sheep. Scanty keep, exposure to much wet, or sometimes a sudden change from poor to full feeding, will variously produce the pelt-rot, which is likewise occasioned by the *scab*. In the last case, the removal of that disease will of course effect a cure; but in the former instances, as soon as a sheep is discovered to be affected (if not too far gone), it should be separated from the flock, and driven into a detached yard, where the diseased part should be cleansed, and the animal anointed with a mixture of turpentine, lard, or other grease, and tar, in such proportion as to form a salve (a piece of cloth being sewed on the animal to keep it from the cold); and where they should be supplied with the best food, an attentive regard to the regular distribution of which, especially in winter, would effectually prevent this malady.

12. *Red-water*.—This malady is sometimes called the *resp*, and is believed to originate from sheep feeding too freely on turnips, clover, or other rich and succulent vegetables. Frequent driving about, and the use of common salt, are said to be successful remedies in the red-water, which, it is asserted, may be prevented by giving the animals dry provender, in the course of the night, after they have been feeding on the vegetables above mentioned. The use of parsley in this malady is likewise said to be beneficial.

* Transactions of the Society of Arts, &c. Vol. xxvi, pp. 126-127.

"This disease* commonly makes its appearance about the beginning or end of winter, and first affects about the breast and belly, although at times it spreads itself over other parts of the body. It consists in an inflammation of the skin, that raises it into blisters, which contain a thin, reddish, and watery fluid. These continue for a short time, break, and discharge their matter, and are followed by a blackish scab.

"When the sheep are exposed to cold or wetness, the skin being fretted, makes the blisters rise; or they often arise from cold affecting the animal internally; thus producing a slight fever, which throws out these vesicles on the body, similar to the scabby eruptions which appear about the face, and more particularly about the mouth, of persons affected with cold. The blood in this disease is but little affected, although a little of it oozes into the vesicles on the skin, and communicates to them that reddish tinge, which gives origin to the name.

"Red-water is a disease that but seldom appears in this country, and is almost never fatal. In cases where the disease is violent, a little blood should be taken. The sheep should be placed in a fold by itself, the blisters slit up, and a little infusion of tobacco put into them, and the following medicine may be given for three or four mornings successively:—Take of sulphur two ounces, honey, treacle, or sirop, three ounces; mix them and divide them into six doses, of which one may be given every morning, in half a mutchkin of warm water. If this is found unsuccessful, half an ounce of nitre, mixed with the foregoing receipt, will be attended with good effects; after which a dose of salts may be given, and the body washed with lime-water upon the parts affected."

13. The *Rickets* occur chiefly in the county of Huntingdon, where they are supposed to have been introduced from Holland. Few diseases are more fatal than the rickets, the causes of which have never been precisely ascertained, so that no remedy applied for its removal has hitherto been attended with success.

The symptoms indicating the existence of this malady, are first, a species of giddiness, which renders the sheep uncommonly wild and fierce; starting up suddenly, and running, on

* Hogg's "Shepherd's Guide," p. 186, &c.

the approach of any person, to a considerable distance, as if it were chased by dogs. In the second stage, a violent inflammatory itching in the skin takes place; the sheep rubs itself violently against trees, hedges, &c. so as to pluck off the wool, and even to lacerate the flesh; no cutaneous eruption ensues, nor does any discharge of matter follow, and every thing indicates a most violent fever. In the last period of the rickets, the progress towards dissolution is very rapid, and the sheep, after reeling about, lying down, and occasionally taking a little food, at length expires.

This disorder is chiefly prevalent in the spring, and is hereditary; so that, after remaining concealed for one or two generations, it re-appears with increased violence. The rickets also appear *suddenly*, in consequence of which circumstance no precaution of the most judicious grazier can detect the malady; hence there is no other alternative, but to cease breeding from such stock. We trust the attention of graziers and breeders will be more particularly directed to this formidable malady.

14. The *Rot*.—Few disorders have been more fatal to sheep, or have more frequently exercised the attention of graziers and breeders than the *rot*; for the origin of which various causes have been assigned. Thus ("Letters and Papers of the Bath and West of England Society," Vol. i.) it is attributed to fluke-worms, that breed in the livers of sheep, whither they are conjectured to be conveyed through the nostrils while the animals are grazing; but these worms are evidently rather the *effect* than the cause of *rot*. The late Dr. Darwin suspected it to proceed from the inactivity of the absorbent vessels of the livers of sheep: so that their bile becomes too thin, particularly in wet or moist seasons. Dr. Harrison, in a recent interesting tract on the *rot*, is of opinion that it originates from *paludal effluvia*, or those unwholesome exhalations that arise from marshes; but to this suggestion salt marshes form a striking exception. And it is a fact, that in the county of Lincoln, in rotting seasons, the sheep fed on salt marshes, which are overflowed by the spring tides, sell at very high prices, from the confidence that they are safe. From an attentive consideration of every circumstance, it is evident, that superabundant moisture, either of food, (experience has proved that even one half hour's feeding on moist or marshy lands, in hot weather, will produce it),

atmosphere, or situation, is the real cause of this dropsical malady; though it is certain, that the dry limed land in Derbyshire will produce the rot as well as meadows that retain water and stagnant marshes; so, in driving sheep to any distance, if they be suffered to lie only one night on a wet spot of ground, whether in an elevated situation or not, they are very liable to the rot.

The symptoms indicative of this fatal disease are thus accurately stated by Dr. Harrison, from whose very able "Inquiry into the Rot in Sheep and other Animals," (8vo. 1804), we have selected them. "When, in warm, sultry, and rainy weather, sheep that are grazing on low and moist lands feed rapidly, and some of them die suddenly, there is reason to fear that they have contracted the rot. This suspicion will be further increased, if a few weeks afterwards the sheep begin to shrink, and become flaccid in their loins. By pressure about the hips at this time a crackling is sometimes perceptible. Now, or soon afterwards, the countenance looks pale, and, upon parting the fleece, the skin is found to have exchanged its vermilion tint for a pale red; and the wool is easily separated from the pelt. As the disorder advances, the skin becomes dappled with yellow or black spots. About this time the eyes lose their lustre, and become white and pearly, from the red vessels of the *tunica adnata* and eye-lids being contracted, or entirely obliterated. To this succeeds debility and emaciation, which increase continually till the sheep die; or else ascites, and perhaps general dropsy, supervene, before the fatal termination. These symptoms are rendered more severe by an obstinate purging, which comes on at an uncertain period of the disorder. In the progress of the complaint, sheep become what the graziers call chокered, i. e. affected with a swelling under the chin, which proceeds from a fluid contained in the cellular membrane under the throat.

"In five or six days after contracting the rot, the thin edge of the small lobe of the liver becomes of a transparent white, or bluish colour, and this spreads along the upper and lower sides, according to the severity of the complaint. Sometimes it does not extend more than an inch from the margin. In severe cases, the whole peritoneum investing the liver is diseased; and then it commonly assumes an opaque colour, interspersed with dark red lines or patches. The upper part of the

liver is sometimes speckled like the body of a toad, to which it is said to bear a striking resemblance; round the *ductus communis choledochus* and hepatic vessels, a jelly-like matter is deposited, which varies according to the severity of the attack, from a table spoonful, or less, to five or six times that quantity. Upon boiling, the liver loses its firmness, and separates into small pieces in the water, or remains soft and flaccid.

"Several graziers and butchers, with whom I have conversed at different times, having observed that sheep are much disposed to feed during the first three or four weeks after being tainted, omit no opportunity of producing it, to increase their profits. When the first stage is over, flukes begin to appear in the *pori biliarii*, the *ductus communis choledochus*, and in the gall-bladder. At first, the quantity of these creatures is small; but, as the disease advances, they increase, and before death are often very numerous. In the last part of the complaint, they are sometimes to be found in the stomach, as well as in the intestines and liver. This, like the visceral disorders of the human body, may terminate in resolution—effusion—suppuration, or schirrus.

1st. "The complaint is said to terminate in resolution, when the inflammatory action goes off, without destroying the state and texture of the parts. However, I am strongly inclined to believe, that every considerable inflammation in the human body, and in other animals, although it ends in resolution, leaves behind it some remains, which may be discovered by an experienced anatomist. When the vessels are thrown into inflammatory action for a few days only, effusion commonly takes place, and the coats become thicker, and assume a buffy colour. These changes in the sanguinary system often continue through life, and lay the foundation of many chronic and incurable disorders. Sheep that recover from the rot exhibit very different appearances after death, according to the severity of the attack; but the taint is seldom or never entirely removed. I was desired, within these few days, to look at the liver of an old ewe, that died fat, and contained fourteen pounds of suet in her body. The back part of the small lobe was dappled with whitish spots; the coats of the *ductus communis* and *pori biliarii* were considerably thickened, and more solid than usual. In colour, they resembled the human *aorta* in old people, and were full of flukes; in other respects the

liver appeared to be sound and natural. The butcher asserted, that the variegated appearance and alteration in the ducts, were occasioned by a slight taint of long standing, which had not been considerable enough to disorder the economy, or impair the health of the animal sufficiently to prevent its feeding.

2dly. "When sheep die suddenly in the first stage of the disorder, an effusion of serum, or of wheyish-coloured fluid, may be commonly discovered in the cavity of the abdomen, and then the *peritoneum* surrounding the liver is generally covered with a membrane or coat of coagulable lymph. This form of the rot has been frequently confounded with the resp, or red-water, though it differs from the latter disorder in the colour of the effused liquid, in being much less disposed to putrefaction, and in several other particulars.

3dly. "Abscesses in the liver exhibit another termination of this malady. They are seldom considerable enough to kill immediately; but, in consequence of the absorption of purulent matter from them, the sheep frequently waste away, and die hectic or dropsical. When the collections are small, sheep will recover sufficiently to bear lambs, for three or four seasons, and afterwards become tolerable mutton.

4thly. "The most common termination is in schirri, or what the shepherds call knots in the liver; I have seen the whole substance of this important viscus so full of small, roundish lumps, or schirrous bodies, that it was difficult to find any sound part in it. The first attack is unfortunately so very insidious, that the disorder is scarcely observable, before the animal begins to waste and lose flesh. In this advanced state it is said to labour under the rot, or *pourriture*, from overlooking the commencement of the disorder."

Equally various with the conjectures respecting the origin of this destructive disease, are the remedies which have been recommended. The late eminent botanist, Miller, advised *parsley* to be employed as a preventive, which is eaten with great avidity by sheep, (the delicacy of whose flesh it greatly improves), as instances have occurred where sheep, fed on *parsley*, remained sound, while those in the neighbourhood were affected with the rot. Mr. Mills, therefore, recommends sheep to be fed with that vegetable twice in the week, for two or three hours each time. In places where the rot is usual, it will be advisable uniformly to fold sheep (where that practice is

retained) before the dew falls, and to confine them in such folds till it evaporates, both in the spring and summer; feeding them with sweet hay, or other dry provender. In the Bath papers already referred to, it is remarked, that no ewe is ever subject to rot while she has a lamb by her side; and it is there recommended, to place sheep that are affected with this distemper, so that they can get at the bark and young shoots of elder. Mr. Price (in the same practical work) advises every farmer to remove his sheep, in wet and warm seasons, from such lands as are liable to occasion the rot; but, if this object cannot be obtained, he directs a spoonful of common salt, and a like quantity of flour, to be given to each sheep in a pint of water, once or twice in the course of the week, by way of preventive. And, in case the disease be in an incipient state, he is of opinion, that the giving of such a dose for four or five mornings successively will probably effect a cure; for the addition of the flour and water not only abates the pungency of the salt, but also disposes it to mix more gradually, and consequently more effectually, with the chyle. The late Dr. Darwin, however, conceived that salt would be more efficacious if it were combined with iron filings and flour, and made into a ball, to be given every morning successively for a week. Further, as a preventive, it has been recommended by Mr. Varlo, an experienced agriculturist, to give each sheep a spoonful of common salt once a week, when a "*rotting season*" is apprehended; and, when the animals are accustomed to it, he directs some dry salt to be laid on flat stones, in various parts of the pasture, as they will then lick it up without any further trouble.

Having devoted such a considerable space to the examination of the causes, &c. of this destructive malady, the reader will, we trust, pardon the prolongation of this article, on account of the following very important operation, which is practised by the German sheep-farmers, and the happy effects of which have been *incontestably proved*.* We refer to the *inoculation* of sheep for the rot, which produces in them the same effect as variolous inoculation does on the human frame. The inoculated animals contract the disorder, the symptoms of which are very mild, and the recovery from which is both speedy and certain. From the experiments, which have been made, it has been

* Lasteysie's "*Histoire de l'Introduction*," &c. p. 193.

proved, that *inoculated flocks are protected from all contagion*. Rams, tainted with the rot, have been coupled with inoculated ewes, which, together with the lambs that sprung from these embraces, have presented no symptom whatever of the rot.

"The inoculation is performed by making an incision in the inner face of the thigh, from which the wool is stripped, about four fingers distant from the anus. The incision must penetrate the skin; but care should be taken not to wound any muscle, lest an effusion of blood should ensue. A pustule of an infected animal is next squeezed with the fingers; and, after taking away the virus thence issuing, on the point of a lancet, it is transferred to the wound of the individual which is intended to be inoculated."

M. Lasteyrie also states, that experiments have been made in France, with a view to ascertain whether *vaccine inoculation* would preserve sheep from the rot. The results he had been able to obtain (1802) appeared to him satisfactory; and he thinks it probable, that this new preservative may be advantageously substituted for that we have just described.*

Beside these *preventive* remedies, various medicines have been recommended to the attention of farmers and breeders; though we conceive, they can only be employed with probability of success in incipient cases. Of these remedies we select the following:—1. Put a handful of rue into a pailful of water in the evening, and on the following morning add such a quantity of salt as will make a brine strong enough to float an egg. Half a pint of this infusion is to be given, as a dose, every other day, for a week.—2. Infuse soot in strong brine and stale urine, and give each animal six or seven spoonsful for eight or ten successive days.—3. Ellis recommends a peck of malt, or more, to be mashed and brewed into twelve gallons of wort, in which a quantity of bloodwort, comfrey, pennyroyal, plantain, sage, shepherd's purse, and wormwood, are to be boiled; the liquor to be worked with yeast, some common salt to be added, when it is to be put into a cask for use. Of this medicated beer seven or eight spoonsful are to be given to each sheep, once in the course of a week during wet weather; but with longer intervals in dry seasons.

* Lasteyrie, p. 194.

Among other remedies, we would here notice a patent which was granted to a Mr. Thomas Fleet, in October 1794, for a medicine, which he affirms will not only prevent the rot in sheep, but also check the farther progress of the disorder in such as are already affected; *so as to render them capable of being fattened on the same herbage which produced the disease.* His restorative medicine consists of the following articles, the proportions of which, however, are *not stated* in the specification of his patent, viz. alkanet root, antimony, Armenian bole, bark, camphor, mercury, opium, salt, sulphur, turmeric, turpentine, and distilled water; which multifarious ingredients are simply directed to be prepared *according to chemical, and compounded according to medical art.* (Not having had experience of the effects of this celebrated nostrum, we cannot say how far it answers the properties claimed for it by its inventor; hence we shall only add, for the information of such of our readers as may be disposed to venture a trial of it, that the remedy in question is prepared by a Mr. Thomas, of Basingstoke, in the county of Hants).

We shall conclude these remarks on the prevention and cure of this tremendous malady, with the following interesting observations selected from Dr. Harrison's valuable "Inquiry," already referred to:

"It is confirmed by experience, that whenever any place is laid dry by judicious management, it ceases to occasion the rot. For my own part, I am acquainted with many sound parishes, which, during their open state, were so injurious to man, and to other creatures, that I cannot sufficiently impress upon my readers the importance of effectual drainage, for the preservation of health. When, from circumstances, the land cannot be laid dry, during the summer months, it requires to be occupied with great caution, since moist grounds are the most prejudicial and dangerous to animal life. I have had occasion to observe, that miasmata are produced in some way or other by the sun's action upon moist ground, and, therefore, when it is well covered with grass, early in spring, we have less danger to apprehend, provided we maintain a deep herbage till the commencement of frosty weather.

"Mr. Young, of Claxby, is of opinion, that when land is well covered with grass it becomes less dangerous to cattle. In 1792, he divided a flock of sheep, and placed fifty upon

some good^d aftermath, where, in other seasons, the rot had frequently prevailed. Only this part of his flock escaped the disorder, which he attributed to the meadow not having been grazed before it was well covered, and defended from the weather.

"Luxuriant pastures seldom rot, unless they be eaten bare in hot weather. Whilst the ground is well concealed, it is so completely defended and protected, that the sun exerts no deleterious effects upon it. In the fatal year, so often particularized, Mr. Elmhirst, of Bag Enderby, an experienced and zealous agriculturist, who occupied two hundred acres of land in the parish of Croft, near Wainfleet, sold all his heavy beasts, and many sheep, early in the summer. His pastures were thinly stocked with sheep only, during the rest of the year. The rot was extremely destructive in all the adjoining pastures, yet in his closes it never appeared. This exemption from the general calamity of his neighbours he attributed partly to his land being always well covered with grass, and partly to his grazing during that summer entirely with sheep. In wet weather, beasts and horses, by treading the ground, leave footmarks, where the water stagnates, and in consequence of it, as he believes, the rot is produced. In justice to the testimony of Mr. Elmhirst, it may be proper in me to add, that he has been an active and judicious cultivator of land, on a large scale, for a great number of years; every observation of his is, therefore, entitled to particular attention.

"I have remarked, that sheep are most liable to rot immediately after losing their fleeces; and in the month of November, when the cold first begins. No rot can be contracted without warmth, or in spring, before the sun's influence is become considerable; but, when the disposition is once acquired, it can only be subdued by frost, or a long succession of cold weather. Gabriel Plats assures us, with confidence, derived from the experience of seventy-four years, that the only infectious months that beget the great rot are May and June, when excessive moistures befall those months. In a few instances, it has appeared in April, when showery weather and great heats have prevailed. In ordinary years, meadow may be irrigated till May, without any injury to the occupier. In doubtful cases, the generation of miasms will be effectually restrained, by continuing a copious and regular watering till the

grass is well grown. The late Mr. Bakewell was of opinion, that after May-day he could communicate the rot at pleasure, by flooding, and afterwards stocking his closes, while they were drenched and saturated with moisture. In summer, rivers and brooks are often suddenly swollen by thunder storms, so as to pass over their banks, and cover the adjacent low lands. In this state no injury is sustained during the inundation; but when the water returns to its former channel, copious exhalations are produced from the swamps and low lands, which are exceedingly dangerous to the human constitution, and to several other animals as well as sheep. I formerly mentioned, that during the summer Mr. Harrison could give the rot to his sheep in a few minutes, by grazing them upon the moist soft land, from which the water of the Barlings had just retired. While there is any current, the sheep will never become tainted, although they often wade in search of their food.

"When miasmata are once formed, they preserve their noxious powers and destructive influence unimpaired, till the cold weather puts an end to their force and activity. In mild seasons, epidemic diseases have been known to afflict the human constitution, during the greatest part of winter; and the pastures which have once become unsound, are only to be recovered by the setting in of frost, or a succession of cold days and nights.

"The autumn and winter of 1799 and 1800 were remarkably mild and warm. At Candlemas time, sheep that were pasturing on the fen and commons at Walsinbrough, near Lincoln, took the rot, and died in the following autumn. No farmer in that parish recollected to have suffered, at any other time, from the rot in spring. Mr. Thompson, of Horncastle, informs me, that many years since, his brother occupied a low, wet close in the parish of Hatton, and lost all his sheep, before winter, of the rot. From that time the land remained unemployed till about Candlemas. It was then filled with strong, healthy sheep; but they were all rotten, and many of them dead before the following May-day. He recollects, that there was very little frost during that winter, and consequently the effluvia were kept alive by the abundance of the herbage. Platts gives it for an infallible symptom, that when bees fail, and their hives feel light, a great rot of sheep is to be expected; which gives a very seasonable warning to bleed the sheep under the eye, or in

the mouth, as oft as they see occasion in the end of summer, or in autumn; or to accustom those which are suspected, to lick salt in troughs, or to take some brine with dry food, as they may be easily trained to it by gentle degrees; or to force down a dose of salt, as is directed.

"Where necessity requires the pasturage of moist grounds in summer or autumn, the shepherd ought carefully to remove his flock into a dry situation before the evening, and provide them with corn and good hay, or green food."

Upon the whole, from whatever cause the rot may proceed, it is evident, that the chief thing on which the farmer can depend is, that of changing the situation of the sheep to a dry spot, or of keeping them in warm and well-sheltered yards, and regularly giving them sweet, dry keep. If medicine be necessary, let a ball be given daily, for a fortnight, composed of five grains of muriated quicksilver, and one grain of opium, in camphor or turpentine; increasing the proportions, if the operation be deficient, and with slight intervals, if the balls operate too powerfully. When the sheep begin to recover, salt should be constantly given them with dry food; and, when they are turned out, they should be driven to a dry, salubrious, and elevated sheep-walk, or into a salt-marsh, if there be one in the vicinity.

15. The *Rubbers*, or *Rubs*, is a species of itch, which renders sheep extremely restless, and in consequence of which they rub themselves to death, being completely, but gradually, exhausted, from not being able to feed. Their skins are perfectly clean; and, when dead, their flesh becomes of a greenish hue, without possessing any bad taste. Those animals which are fed on fine, rich soils, are more liable to the rubbers than those which are pastured on poor lands; and the disease usually terminates in the course of three or four months. No effectual remedy has been hitherto discovered; though it is probable that relief might be obtained by washing the diseased sheep with strong soap-suds or ley, or by recurring to the remedies employed for the scab.

16. *Scab*.—This disease is likewise known by the name of *shab*, or *ray*, and is attended with an intense itching, and cutaneous, scabby eruptions, occasioned by the impure state of the blood. It prevails chiefly in wet situations, and during rainy seasons; and as the scab is said to be infectious, the diseased

animals ought, in every case, to be separated from the rest of the flock.

The scabbed sheep should next be washed with a strong decoction of tobacco in brine, (in the proportion of one pound to two gallons), to which a little oil of turpentine has been added; or, in inveterate cases, with a lather of black soap, lime water, or sublimate water, and oil of turpentine; sulphur and bay salt, or Glauber's salt, being administered internally. The following preparation has also been found effectual: Mix one pound of tobacco, one ounce of white arsenic, one pint of oil of turpentine, and six quarts of beef brine, with a small quantity of tar, and boil the whole till the ingredients become incorporated so as to form a liniment; in applying which every scab must be *broken*, and the sheep be well rubbed, that the liquid may penetrate every part. Another efficacious remedy was communicated by Sir Joseph Banks to the "Society for the Encouragement of Arts, Manufactures, and Commerce," in 1789, from whose Transactions for that year we have selected it.

Let one pound of pure quicksilver, Venice turpentine, and common oil, of each half a pound, and four pounds of hog's lard, be triturated in a mortar till the quicksilver is thoroughly incorporated with the various ingredients. In applying this ointment, the head of the sheep must be first rubbed; after which a furrow is to be drawn with the finger, from the region between the ears, along the back to the point of the tail, so as to divide the wool, till the skin be exposed to the touch. Then the finger, being dipped into the unguent, must be drawn along the skin; and similar furrows should be made down the shoulders and thighs, as far as the wool extends; and if the sheep be much infected, two other lines, or furrows, ought to be drawn parallel to that on the back; and one should also be traced downwards on each side, between the fore and hind legs. After this application, it is stated, that the sheep may be turned out among the flock without fear of communicating infection, as the blotches will in a few days dry up, the intolerable itching will subside, and the animals will be perfectly cured without any injurious effects resulting from the use of such unction. But this external remedy should, in the opinion of Sir Joseph Banks, be not delayed longer than Michaelmas.

But, says Mr. Hogg, (Shepherd's Guide, p. 96,) the most

effectual cure is that which can now be got in any apothecary's shop, known by the name of *sheep ointment*. It is a strong mercurial composition; and the most safe way is, for the apothecary to put it up in small balls, each of which he may deem sufficient, and safe to be rubbed upon a sheep at once; for as different hands may make it of different strength, the most experienced applier can hardly be a competent judge how much is sufficient for each animal, without some such precaution. Let the shepherd, then, take one of these balls at a time, and mix it with three gills, or a mutchkin of train oil, and if the animal be thoroughly infected, put the whole of this upon it, as close to the skin as possible; but if it is only scabbed or itching on some parts of its body, perhaps each of these mixtures may serve two. If the infected parts are mostly on the back, or upper parts of its body, the shepherd must make a shed, or opening of the wool, exactly on the very ridge of the back, from the crown to the tail; let him shed it clean to the skin, and keep it open with both hands, while another pours in the ointment from a common tea-pot. He must not keep the wool too close down with his hands, else it will cause the ointment to drip upon it. In this case, a few sheds, or openings, will do; but if it is scabbed about the belly and throat, it must be shed very thick, and the ointment rubbed on the skin with the fingers, as it cannot then spread in the skin by running. Let it always be done in dry weather; and it is a safe and certain remedy, though perhaps the scab may again appear on the offspring of this flock.

17. The *Tick* is a small, brownish, and flat insect, infesting sheep, and which, if not speedily destroyed, materially injures both the flesh and wool into which it insinuates itself. When the vermin have settled, scabs are formed on the surface, whence a small quantity of matter issues: as the insects increase in growth, the scab becomes proportionably larger, and at its full size nearly resembles a middling-sized horse-bean. In order to remove these noxious vermin, (which spread very rapidly), it has been recommended to separate the wool, and to wash the diseased spots two or three times, or oftener, if necessary, with a liquid preparation, consisting of one ounce of cream of tartar, and a quarter of a pound of bay salt (both finely powdered and sifted), and one ounce of corrosive sublimate, mixed together in two quarts of soft water. Or, four

pounds of soft soap, and two pounds of arsenic may be steeped in thirty gallons of water, and the animals be immersed in the infusion, their heads being carefully kept above water, and the sheep being sheltered from rain for one or two days. The wool must be closely pressed, and the liquor that runs off be caught in a tub, or other vessel, for future use. Of this application it is sufficient to state, that it is approved of and used by those eminent agriculturists, Lord Somerville and T. W. Coke, Esq. of Holkham-Hall, in the county of Norfolk: the proportion above specified is sufficient to bathe forty lambs. The preparation by Mr. Priest of Norwich, (mentioned above § 3, p. 211), may also be beneficially employed in this disease.

18. *Affections of the Udders of Ewes.*—After the lambs are weaned, the lacteal ducts of ewes' udders are liable to various obstructions, in consequence of hard tumours being formed, which are accompanied with inflammation; and which, if not shortly relieved, will terminate in a mortification in twenty-four hours. As soon as such tumours are discovered, the wool must be shorn closely off, and the part affected be frequently rubbed with camphorated spirit of wine. Should suppuration ensue, the parts must be opened with a sharp knife, or razor, and the morbid matter expressed, when a little fresh butter, or any common healing salve, may be applied to the wound. Ewes, when thus affected, ought to be kept separate from the flock; and, though one teat may probably be lost, yet she may be allowed to suckle her lamb; but, when both teats are affected, there is no alternative but to fatten her off for sale, and to bring up the lamb by hand.

19. *White Scour.*—This disorder is a peculiarly violent and uncommon looseness, occasioned by sheep feeding on putrescent vegetables, especially the shells of turnips, when suffered to lie on the ground after the flesh or pulp has been scooped out. The diseased sheep must be separated from the flock, and three large spoonfuls of the following mixture be given them, every second or third day, as the nature of the case may require: Mix half a pound of finely-powdered and sifted dry bay salt with one pint of old verjuice, and then add half a pint of common gin. As poverty of keep is the primary cause of this malady, the animals must be allowed the best and most wholesome dry food.

20. *Wounds.*—Besides the various casualties above speci-

fied, sheep are liable to receive injuries from being wounded by thorns, &c. or worried, torn, or bitten by mischievous dogs, or such as are not thoroughly broken in. Although such accidents may be in general prevented by due care and attention, yet in cases of common green wounds it may be necessary to apply some healing or emollient balsam or salve. With this intention let one ounce of myrrh, a similar quantity of Socotrine aloes, and four ounces of purified turpentine, be mixed with a quart of good brandy in a bottle. The vessel should be corked up, and exposed for one or two weeks to a moderate heat, after which it may be strained off, and preserved for future use in a closely-stopped bottle.

Lastly, the farmer or shepherd ought frequently, if not daily, to examine his flock, and see that their tails and buttocks be kept perfectly clean, otherwise they will become *tagged*, or belted, i. e. the skin will become excoriated and sore from the dung that adheres to those parts, especially when the animals are affected with the flux, or white scour. Where this is the case, the sheep must be taken into a dry, separate yard; and well washed with soap-suds, the wool around the sores being previously removed; after which the wounded parts may be strewed with finely-pulverized white lead or chalk, and this may be succeeded by rubbing them with a mixture of brandy and tar.

SECTION IV.

DISEASES OF LAMBS.

It sometimes happens that lambs, when yeaned, are apparently lifeless, in which case it will be proper to blow into the mouth and nostrils;—a simple expedient, which has been the means of restoring multitudes of these useful animals.

The *Black-water* is one of the most fatal maladies to which lambs are subject; the cause is not precisely ascertained, but the disease carries them off very suddenly, and occurs chiefly in the autumnal quarter. The best preventive hitherto known is, to keep them on very dry pastures.

The *Blood*, or *Red-water*, likewise often proves a mortal distemper to lambs. Its symptoms are, lameness and a slight

swelling of the joints, accompanied with a violent inflammation that spreads over the whole animal; and which, if disregarded, terminates its existence in the course of twenty-four hours. This disorder is produced by too great a quantity of food remaining on the stomach, in a crude and undigested state. As soon, therefore, as the disease appears, the lambs must be taken home from grass, be bled, and an emollient clyster administered. Two or three ounces of castor oil, or as many grains of emetic tartar, should next be given, and the bleeding repeated, if no favourable symptoms appear; the treatment above specified being continued for four, five, or six days, as the case may require; and, during that term, the lamb should be fed with milk.

The *skit* is a kind of scour, or diarrhœa, and is sometimes divided into *green* and *white*, according to the appearance of the dung. Give a decoction of hartshorn-shavings and finely-scraped chalk, in which a few grains of opium have been dissolved, and keep them on dry, wholesome food, in a well-sheltered yard.

SECTION V.

DISEASES INCIDENT TO SWINE.

IN the management of swine, various hints have already been given for the regular supplying them with food, and a due regard to cleanliness; these *attentions* cannot be too forcibly impressed, as, on account of the unruly habits of these animals, they are the worst patients with which a farmer can be tormented.

1. *Gargut*.—This is an inflammatory affection of the udder, or bag, being distended with coagulated milk, whence the lacteal ducts are obstructed. It is chiefly occasioned by not *sucking down* in proper time; though too rich keep, before the time of farrowing, will also produce this malady. In slight cases, the udders may be bathed with camphorated spirit of wine; but as young pigs will never suck their dams when the milk becomes vitiated, there is no alternative but gently to express the corrupted milk, if it can be effected; otherwise it will be best to kill the sōw, which must necessarily perish from the inattention above noticed.

2. *Fever, or rising of the lights*, as it is likewise called; appears to originate from over-feeding; it may be removed by administering a mixture of sulphur and oil.

3. *Diseases of the Lungs*.—These are generally accompanied with a dry, husky cough, and wasting of the flesh, occasioned by too great exposure to cold and wet. The best remedy is a warm, dry stie, with a regular supply of food that is calculated to keep them cool, and allay the irritation attendant on their cough.

4. The *Mange*, like the scab in sheep, is a cutaneous eruption, occasioned by inattention to cleanliness in hog-sties. It is easily known by the violent rubbing of swine against trees, or any hard substance, with such violence as to tear away the head of the pustule, and to produce a disagreeable scab. When this disease appears, the animal affected must be separated from the rest of the herd, washed thoroughly with a strong soap-ley, and anointed with the following unguent, recommended by Dr. Norford ("Annals of Agric." Vol. xv). Incorporate one ounce of fine flour of sulphur, two drachms of fresh-pulverized white hellebore, three ounces of hog's lard, and half an ounce of the water of kali (as prepared in the shops), so as to form an ointment. This is to be rubbed in at one time, and is said to be sufficient for a beast of six or seven stone: if properly applied, Dr. N. states that no repetition will be necessary, if the hog be kept *perfectly clean* after the cure is performed. In case there is a slight cough, he directs from half an ounce to one ounce and a half of crude antimony, according to the size of each animal, to be finely pulverized and mixed with his daily food, for ten days or a fortnight, when the swine will be perfectly restored. But if, from long neglect, the neck, ears, (especially in the large, lop-eared hogs,) or other parts become ulcerated, they should be anointed every third or fourth day with a little tar ointment, prepared by mixing equal parts of mutton suet and tar over a gentle fire, and straining such mixture while hot.

5. *Measles*.—This disorder exists chiefly in the throat, which is internally filled with small pustules, or tumours, that sometimes appear on the outward surface of the neck. It is known by the languor and decline in flesh of the animal affected, and may be removed by giving small quantities of levigated crude antimony in his food.

6. The *Murrain*, or *leprosy*, in swine, is indicated by shortness and heat of breath, heads hanging down, staggering, and a secretion of viscid matter from the eyes.—*Cause*: chiefly hot seasons, in consequence of which the blood becomes inflamed.—*Remedy*: boil a handful of nettles in a gallon of small beer, then add half a pound of flour of sulphur, a quarter of a pound of pulverized aniseeds, three ounces of liquorice, and a quarter of a pound of elecampane. Give this liquid in milk, at six doses; and keep the diseased animals on wholesome food. But the best preventive is to keep swine clean and cool in summer, and to allow no carrion, or filth whatever, to remain near their sties.

CHAP. V.

IMPLEMENTS OF HUSBANDRY.

No department of practical mechanics has, perhaps, been more assiduously cultivated, of late years, than that which has for its object those implements which are used in the various branches of *husbandry*, (including in that term the whole of rural and domestic economy); such as churns, wheel-carriages, ploughs, hoes, &c.; the most important of which will be noticed in the following pages. But notwithstanding the attention that has been thus bestowed, in the construction of more perfect machinery, calculated to facilitate the various operations, and, consequently, the improvement of husbandry, especially by the premiums and donations given by the numerous British patriotic Agricultural Societies; much still remains to be done in this important branch of economy, particularly with regard to simplicity of construction, and facility in using the respective implements; and, we trust, the period is not far distant, when these desirable objects will be completely attained, since the most respectable individuals of this highly-favoured island have not disdained to devote their attention to this subject.

SECTION I.

WHEEL-CARRIAGES.

THE wheel-carriages most commonly used for the various purposes of rural economy, are *waggons*, the structure of which is of different forms and dimensions in various counties; but they are, in general, too unwieldy to be employed with effect and convenience, though sanctioned by long use and custom. The waggons of Norfolk are of a middle size and height; where, on a farm of a moderate size, three or four are mostly kept; in that district, however, the farmers avail themselves, during harvest, of the advantages afforded by waggons, without the inconvenience resulting from their weight. With a common dung-cart, and a pair of old waggon shafts and fore-wheels, a carriage is formed; which, as it partakes both of a waggon and a cart, is called a *maphrodite*, or more properly, an *hermaphrodite*, (Marshall's "Rural Economy of Norfolk," Vol. i.) In this vehicle, the points of the shafts rest on the *bolster* of the fore-wheel, to which they are fastened. A *copse*, or fore-ladder, similar to that which is sometimes fixed upon cart shafts, but longer, is also supported by the bolster, projecting over the horse in front, in the manner of the fore-ladder of a waggon, so that the length and breadth of the hermaphrodite vary very little from those of a waggon. In hilly districts, "where carts are in a manner useless in harvest," Mr. M. conceives that the cart waggons would be found very convenient.

In his opinion, however, ("Rural Economy of Gloucestershire," Vol. i.) the Gloucestershire waggons are preferable to any others; but they are not so high as those of Norfolk; for, the former having a crooked side-rail bending in a kind of arch over the side wheel, their frames or bodies (in some parts of England denominated the *buck*) are kept low, while the diameter of the wheels is not materially lessened. The bodies are also made wider, according to their shallowness, and the wheels run six inches wider than those of the generality of waggons; in consequence of which, it is obvious that very great advantages are obtained in carrying top-loads.

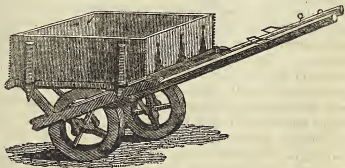
Further; there is a peculiarly useful waggon employed in the county of Berks for the purpose of carrying turf, grain, and other articles. These carriages are greatly superior to the generality of the vehicles occurring in the more western and southern districts, from the neatness of their structure, as well as the facility with which they may be drawn; while they have sufficient strength, without the unwieldiness and weight of the other waggons. But, with all their excellence, as they are now made, the Berkshire waggons are subject to one great inconvenience; by which a considerable portion of time is lost, in turning at the end of swaths, carrying hay, as well as in carrying corn, and many other articles. This disadvantage, however, may be obviated, without detriment either to the strength or proportion of the waggon, by adopting the valuable suggestion recently given in the "Agricultural Survey" of that county, viz. by leaving a space of sufficient depth in the bed of the waggon to admit the fore wheels to lock round in the shortest curve.

It would far exceed the limits of the present work to notice the waggons of every district, or county, especially as the indifferent principles on which they are constructed incontestably prove, that there are few implements of husbandry that are of more importance, or perhaps capable of more essential improvement than wheel-carriages. Nor can we but be surprised at the predilection, or infatuation, which has so long prevailed in favour of large teams and waggons, in regard to which Dr. Anderson has appropriately remarked, ("Recreations in Agriculture," &c. Vol. iv.), that the great object of emulation seems to be, to try how an immense load of goods may be transported in one carriage, and at one time, without respect to any other circumstance. Such a procedure is in direct opposition to the best and most established principles of mechanics, economy, and of common sense, as we hope to prove by the subjoined remarks.

Where such large machines are constructed, the various parts must be made so proportionably thick, that the very weight of the implement itself is a load, which not only subjects the owner to a great and needless expense in the cost, but also compels him to incur a great expense for horses, or other cattle, to drag that unnecessary load from place to place, while the latter might be more beneficially employed in tillage.

And, when four, five, or any larger number of horses are yoked to a team, three of them must draw in a horizontal direction, and consequently in a manner totally inconsistent with their mechanism. Further: the very large *wheels* of waggons materially increase the draught of horses, because the slow motion of those carriages obliges the horses to overcome their *vis inertia* every moment they are drawing them; that is, it is the same thing as putting it into a state of motion from a state of rest every moment; for no one is ignorant of the small force that is capable of keeping a heavy body in motion.

These remarks are as applicable to *stage* or *road waggons* as to those which are used for the purposes of husbandry; though it has been suggested, that, in performing distant journeys through level and substantial roads, where road waggons are *constantly* and *fully laden*, one of them may be employed with as much benefit as two or more vehicles of smaller dimensions. Where, however, dispatch and celerity are required, as in housing hay, &c. it is obvious, that such ponderous machines are unfit for the purpose. A good horse, it may be observed, can draw upwards of a ton, or 2,000 weight; in drawing which a great portion of the animal's strength is exhausted in pulling the waggon, rather than the load it contains, to which his strength ought to be applied. Hence several judicious farmers have availed themselves of lighter carriages, for conveying different articles to and from land, so as in a great measure (and in Ireland, and in a few other places entirely,) to supersede the use of waggons. For this purpose the *improved Irish car*, of which the subjoined figure will convey an outline,



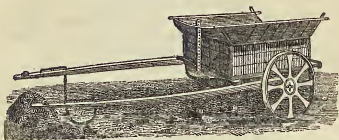
is superior to any other vehicle that can be employed. Nothing,

indeed, Mr. Young remarks, can surpass the amazing speed, with which corn and hay fields are cleared in Ireland, by means of this useful but inelegant carriage. With regard to form, the Irish car is almost square, the bed being only a few inches longer than it is in breadth; and the wheels, which should be at least six inches broad, are made low and broad, have a flat bearing, and are placed beneath the cart.

The benefits to be derived from this machine, which was preferred to any other by the late eminent farmer and breeder, Bakewell, (by whom an interesting account of it is given in the "Communications to the Board of Agriculture,") are as follow: on account of its lowness it may be easily filled; when narrow or confined gateways and roads occur, much room is gained by the wheels being placed below the body of the car; and it may be drawn with great facility on soft meadow or ploughed lands, with less injury to the latter than is practicable with any other cart. Another advantage is, that the rims of the wheels being cylindrical, the draught is much inclined; consequently there is more facility and less resistance, and heavier weights can be drawn. The superiority of wheels with cylindrical rims over those with conical rims, has been clearly demonstrated by Alexander Cumming, Esq. (in "Communications to the Board of Agriculture," Vol. ii.); and though the nature of the present work forbids an analysis of his long and important paper, yet we trust the annexed brief statement of the inferiority of conical rims over cylindrical ones will not be useless, especially as our remarks are equally applicable to the wheels of any other carriage. In the first place, then, *conical rims* require a uniform or constant force to keep them in a direct line, which force produces an increased friction on the rim; besides, they augment the friction on the axis, and, in dry seasons, reduce the best materials to powder. In wet weather, or when the roads are soft, they break and injure the texture of the ground, render the draught more difficult, and greatly contribute to the wearing of the *tires*. On the contrary, the *cylindrical* rims are altogether free from these detrimental properties: they have a constant tendency to proceed in a straight direction, are subject to little or no friction or rubbing at the circumference, or against the sides of deep ruts; nor do they throw up any dirt by the hind part of the wheel, increase friction on the axis, press against the linch-

pin, and tend to displace or break the texture, or retard the consolidation of the parts on which they revolve. Further: wheels with conical rims, by frequently rolling on compressible substances, render these more level, and impermeable to water; and, by conducing to keep dry the internal and softer parts of roads, they are better enabled to resist injury and support the crust which protects them. Lastly, instead of opening the joints on paved roads, these become improved by the cylindrical rimmed wheels operating as a rammer on the stones over which they pass, from the dead pressure produced by the uniform and equal velocity of every part; and, as they advance in a straight line with the least possible resistance, they serve alike to improve the roads, relieve the cattle, and preserve the *tires*.

But with all the advantages which the *improved Irish cars* above described possess, (and they are confessedly very great), there are some eminent agriculturists, who, after careful consideration and comparison of their merits, conceive single-horse carts to be preferable to the Irish cars. This difference of opinion is not for us to reconcile: it is however certain, that as horses have more power in drawing singly than in a team, these carts are superior to large carriages, by the increased proportion of labour which those animals can perform. And ("Annals of Agriculture," Vol. xviii.) Mr. Young has given the annexed dimensions of a one-horse cart, which he has, after long experience, found to be the most advantageous, viz. the *buck*, or body, is five feet one inch long, three feet seven inches broad, and two feet deep; the cubical feet amounting to thirty-five and a fraction. On a farm, then, comprising three hundred and fifty acres, Mr. Y. states, that he employed only five of these carts, and remarks, that he would not increase that number more than one, though he were to occupy four or five hundred acres. It is worthy of notice, that no farm of equal extent, in an arable district, has less than three waggons, three tumbrils, and a light cart, the expense of which, in 1792, (the time when Mr. Y. wrote his memoir), amounted to 109*l.*, while the building of six carts, according to his plan, cost only 68*l.* (now they would cost about 80*l.*); so that upwards of forty per cent. is annually saved in the article of repairs.



The figure above delineated, represents an excellent one-horse cart, invented by Lord Robert Seymour, who employs it on his estates, with the most complete success. In a valuable communication, inserted in the "*Annals of Agriculture*," (Vol. xxvii.) Lord S. remarks, from actual observation, that one horse, acting by himself, will perform half as much more work as he can do when coupled with another; so that two horses *separately*, can do the work of three *conjunctively*. This difference is occasioned, partly by the single horse being so near the load he pulls, and partly from the line of draught being so much below his breast; the wheels of one-horse carts being mostly very low. Besides, when two horses draw together, one of them is usually inconvenienced by some difference of rate; the horse before or behind him being slower or quicker than himself. On the contrary, a single horse has only his load to encounter, and suffers no inconvenience from the disproportionate height of his companion; nor is it necessary to employ any additional drivers; as, when once accustomed to go singly, horses will follow each other with as much uniformity and steadiness, as when they are harnessed together; so that, on the most public roads in Ireland, one man guides three, four, or five one-horse carts, without any inconvenience whatever to passengers.

The following are the dimensions of Lord Robert Seymour's single-horse cart.—*Body*: across the bottom, two feet eleven inches; inside length, three feet nine inches; height, one foot; sloping top, nine inches.—*Iron wheels*: height, two feet eight inches; rim, three inches and a half in width; spoke, three inches and a quarter at each end, decreasing to two inches at its centre. With a view to furnish a regular supply of grease, his lordship has introduced four cavities or grooves into the



Ox Yokes.



Fig. 1.



Fig. 2.

Carts

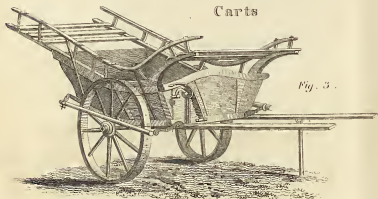


Fig. 3.

Front View of Lord Somerville's Drag Cart.

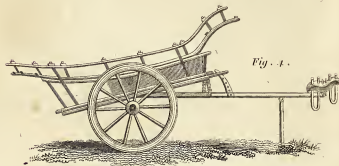


Fig. 4.

Side View of the same Implement.

boxes, which increase a little towards their centres; and, in order to defend the wrought iron axle-tree against the harder end or extremity of the box, he ordered it to be steeled.

In the commencement of his communication, Lord Seymour remarked, that the price of iron cast into wheels, was, at that time (1796), sixteen shillings per cwt., and each wheel weighs about three quarters of a cwt. But there are two objections to the use of low cast iron wheels, *viz.* 1. That such iron is very apt to break on concussion: 2. That the course of a wheel of so small a diameter produces a very quick consumption of grease. The first of these inconveniences is effectually obviated, by the ease with which the rims of such wheels may be repaired, by means of wrought iron; which, when riveted to the cast iron, gives to the wheel a degree of elasticity, and thus renders it, perhaps, stronger than when it was recently made. The latter inconvenience is removed by the contrivance above mentioned, for the regular supply of grease.

In Plate II. fig. 3. and 4. are represented a front and a side view of a *drag-cart*, invented by Lord Somerville; selected from Vol. ii. of "Communications to the Board of Agriculture."—Figure 3. is a cart calculated for draught, by a *single* horse in shafts; *b b* is a *friction-bar*, or drag, that is fixed behind by a chain, and before by a tooth-rack, delineated at *b d*, which catches on a staple, and by means of which the pressure may be regulated by the driver, according to the steepness of the descent: *c* is a toothed rack, fixed in the front of the cart, for regulating the position or centre of gravity of the load. In this figure, the friction-drag is placed lower on the wheel than Lord S. originally intended, in order to divide the pressure and friction more equally on the opposite side of the wheel: thus the action on each is diminished, and the risk of over-heating and destroying the friction-bar is rendered less than if the whole pressure were applied in one point at the top of the wheel.

Figure 5. represents a side view of Lord Somerville's *drag-cart*, designed to be drawn by two strong oxen, with a pole yoke, and bows, the friction-bar being removed. In this figure, a more simple mode is adopted for regulating the position or centre of gravity of the load, as described at *a b* by the curved iron, perforated with holes for receiving a pin, to keep it at any required height: *c* is a small chain to prevent the cart

from going too far back in fixing it; and the letters *dd* denote the upper part of the cart, which is extended to contain bulky or heavy loads.

The following are the advantages to be derived from the adoption of the drag here described, and which is certainly preferable to any other similar contrivance.—1. The degree of friction and pressure may be expeditiously adjusted to the steepness of the declivity; so that the cart will neither press forward, nor require much exertion in the draught.—2. The friction is judiciously applied to the wheel, in such a direction, that a given pressure will produce twice the effect in retarding the progress which it would do if it had been immediately applied to the body of the cart, or to the axis.—3. This apparatus is capable of being arranged with such facility, that it may be instantaneously adjusted, without stopping the cart, or exposing the driver to danger.—And, 4. It may be remarked, that still greater benefit may be derived from Lord Somerville's valuable invention, by applying it to *both* the hinder wheels of *waggon*s; thus the resistance may not only be proportioned to the steepness of the declivity, so as to prevent most effectually, the damage done to the high roads, and the unnecessary labour of cattle, when drawing locked carriages down hills; but also (which is of the utmost importance) it will remove the danger of the frequent accidents to which drivers are exposed; and will in future save that time, which is now of necessity lost, in locking and unlocking waggon-wheels.

Before the subject of carts is dismissed, it may not be amiss to notice one or two carriages of this description, which have been used with advantage in various situations.

The first is the *Cornish wain*; which is, perhaps, the simplest of all wheel-carriages, and is adapted for draught either by horses, or by oxen. It is a cart without a *body*, or more correctly, without *sides*; except only two strong bows or arches, that bend over the wheels, to prevent the load from pressing upon them, with a wince behind: from its lowness, it is easily loaded; and is admirably calculated for carrying home harvest crops; to which purpose it is chiefly applied in that county. In order to prevent the wheels of carts or other carriages, when heavily laden, from making deep ruts in roads, a useful expedient has been suggested by R. Beatson, Esq. It consists simply in fixing between the other wheels, a *protector* (thus he

denominates it) or small roller, or other broad wheel; of which, the circumference of the upper part should be almost one inch and a half below the axle-tree, while the lower one ought to be about that distance from the surface of the ground. This roller is to be secured to the axle-tree, so that it shall be capable of supporting the whole weight of the vehicle, in case the wheels should sink into any deep ruts. The size of the *protector* varies according to that of the wheels; but Mr. Beatson states, ("Repertory of Arts," &c. Vol. viii. *old series*,) that a diameter of two feet will be sufficient for single carts; but that waggons or double carriages will require it to be both larger and broader. By thus raising the roller or protector a small distance above the lower surface of the wheels, the latter will, on good roads, sustain the weight of the load; and, if the middle way or horse-path be firm, they can neither sink into old, nor form any new ruts; as the roller will move in the middle, and consequently afford a more easy draught to the cattle. If due regard be paid to the construction of the *protector*, its additional weight will be inconsiderable; especially when we consider its utility, and the great reduction it may effect, both in the repairing, and in the making of roads.

Lastly, a useful *rolling-cart*, has been employed for carrying manure on low lands, during wet seasons.* It consists of three circular pieces of strong elm, two feet in diameter, and each eighteen inches in length, through which passes a strong iron axis, so as to project a few inches on each end beyond the rollers; allowing one inch between each piece, for the convenience of turning round. On the projecting part of the axis is placed a fixed frame, for sustaining the body of the cart; which may, according to the nature of the soil, be loaded to any degree, or employed for carrying manure, or merely as a roller, on land whereon common wheels cannot be admitted to pass. By means of such rolling carts, the surface of the soil may be frequently compressed, in order that it may be more perfectly consolidated, so that the earthy particles may embrace the roots of the grasses, and retain their proper moisture, on which the luxuriance of such soils in a great measure depends.

* Moyle in "Transactions of the Society of Arts," &c. Vol. xiv.

As wheel carriages are among the most expensive articles of purchase to a farmer, it is of the greatest importance to make them last as long as possible. With this view, Sir John Sinclair has communicated the following receipt for making grease for wheels, *superior* to any other hitherto discovered.

Mix with the ordinary grease used for carriage wheels as much black lead, carefully pounded and sifted, as will bring it to the consistency of any thick soft pomatum, and grease with this. It will last twice as long as the grease commonly applied, or if the motion of the wheels be not very quick, three times as long. The mixture is equally applicable to machines used in agriculture, as to mills, &c.; and has no bad effect whatever in wearing the axle or box. The effect is still further increased, if the axle be iron, and the box brass.*

SECTION II.

CHAFF-CUTTERS, AND BRUISING MILL.

VARIOUS machines, under the names of chaff and straw cutters, have, of late years, been contrived for reducing hay and straw into chaff, and diminishing manual labour; the economy and advantage of which practice have been already adverted to. Most of these are sufficiently calculated for this purpose; but as it would exceed the limits of the present work to enter into a detail of the comparative merits of these implements, we shall, at present, confine our attention to three of the most recent; and which, from their construction and other valuable properties, appear more particularly worthy of notice.

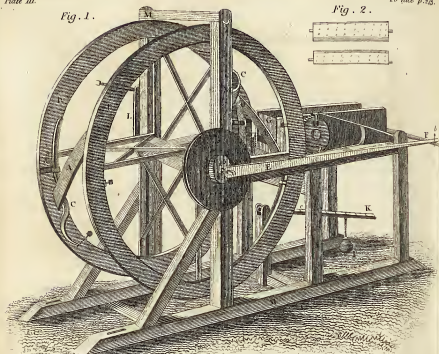
The first of these is Mr. Salmon's chaff-cutter, of which an engraving is given in Plate III. fig. 1. (from the "Transactions of the Society of Arts," &c. for 1797.) The letters A A represent two knives, fixed on the inside of the fellys of two wheels B B, which are firmly connected; and the edges of which

* Sir John Sinclair on the Husbandry of Scotland, Vol. ii. Appendix, p. 114.



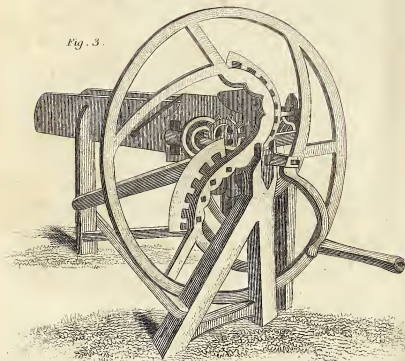
Fig. 1.

Fig. 2.



M^r Salmon's Improved Straw-Cutter.

Fig. 3.



M^r M^r Dougal's Chaff-Cutter.

knives are at an angle of forty-five degrees from the plane of the wheel's motion. And these knives are so arranged, that they are acted upon by the springs C C, which are so adjusted as to give them the degrees of pressure, against the box, requisite to cut the straw: with a view to prevent them from coming too forward, and thus producing an unnecessary friction, wedges are placed beneath the staples *a a*, which must be drawn out as the knives wear, so as to facilitate their progress; by which expedient new knives may be substituted for old ones, as occasion may require, as they will always be regulated by the springs. D is a round block of wood, fixed to one side of the wheel, having four holes and a moveable screw: to this block is fastened, by means of screws, one end of the feeding arm E, that runs in nearly an horizontal direction to the cross-bar F, at the end of the box G. This end is attached to the cross-bar by the pin *b*, which may be shifted to five different holes in F; so that, by means of these, and of the four holes in the block D, *twenty changes* may be obtained in the length of the chaff.

The straw or hay is brought forward by two rollers in the box G, which are separately delineated at figure 2. of Plate III.; and which are turned from the cut side; by the ratch-wheels H, (one being on each side of the box), and move more or less quickly, according as the stroke is given to the cross-bar by the feeding-arm and wheel. Thus, while the knife is cutting, the straw remains at rest; and, on removing the cross-bar F, the supply immediately ceases, although the motion of the knives may continue. I is a pressing weight, suspended below the box, which may be more or less powerful, by shifting it on the bearer K, whence it hangs; this weight may also be inclined to either side, according to circumstances, and will contribute to force the straw towards the knife, while it counterbalances the ratch-wheel of the upper roller. Near the *fulcrum* of this bearer there is a fixed chain, represented by the dotted line E *e*; the upper end of which is connected with a roller, having at each end a small iron bar, that is attached to the end of the upper spiked roller: thus the straw is uniformly pressed between the two cylinders. S is a winch, that serves to turn the machine. The letters M M M M denote the frame of the machine. Figure 2. delineates the two rollers, already noticed in the description of the box G.

In order to make use of this chaff-cutter to the best advantage, Mr. Salmon, the inventor, proposes to place a second box at the end of the first: such second box may be made of any length, and suspended by a line and counterweight; by means of which its end is brought down to a level, while it is filling with straw, and then drawn up, so as to give the second box a declivity; a contrivance by which the straw is brought more expeditiously forward. The advantages resulting from this additional improvement are, 1. The ease with which straw may be cut; and, 2. A very considerable saving in point of time; as it will not, in this case, be necessary to stop at intervals, in order to *feed* the machine. The price of Mr. Salmon's chaff-cutter, we understand, is about twelve guineas.

In Plate III. figure 3, is given an engraving of a patent chaff-cutter, invented by Mr. Macdougall, of Oxford-Street, by whom we have been favoured with an original drawing of it, for the use of this work. It possesses, in a superior degree, *facility in working*, so that much time is saved in labour. The hay, straw, &c. intended to be cut into chaff, may be pressed as hard as the labourer pleases, by merely placing a weight nearer to the end of the lever. It should be observed, that, in the common chaff-cutters, an endless screw is usually inserted; for this Mr. M. has, with great judgment, substituted a spiral groove, by which excellent contrivance he has in a great degree removed friction, so that the lever may rise to any height, without deranging the order of the machinery. Should this straw-cutter, however, be broken or injured, through any accident, or the carelessness of servants, Mr. Macdougall has been especially attentive so to construct his implement, that it may, in such case, be easily repaired by any common mechanic; an important advantage this, which constitutes one of its chief excellences, and in which the generality of chaff-cutters are miserably deficient.

A third useful machine for cutting straw, is delineated in Plate IV. figure 1, which has been obligingly communicated by its inventor, Mr. Thomas Pasmore, of Doncaster, in the county of York. As the component parts of this valuable implement are specified in the engraving alluded to, we shall only observe, that repeated trials have satisfactorily evinced its efficacy, for the purpose of cutting straw for cattle: and "the

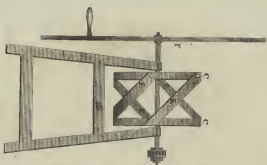


Fig. 1.

Fig. 1. PASMORE'S PATENT MACHINE for
Cutting Straw.

- A. Feeding Trough.
- B. Apron or Rack.
- C. Frame to which the levers are attached.
- D. Lever to which the straw is attached.
- E. Lever to which the straw is attached.

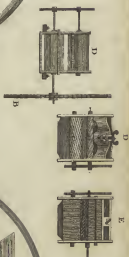
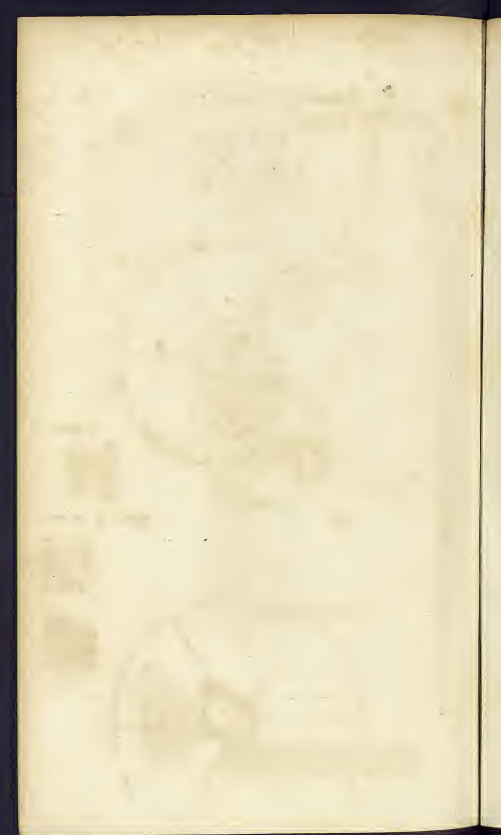


Fig. 2.

Fig. 2. PASMORE'S PATENT MILL.
for splitting Beans, crushing Barley, Oats, Malt &c.

- A. Hopper to contain the corn.
- B. Side view of Mill see detail in Part.
- C. Top view of Mill see detail in Part.
- D. The rollers about the top rollers are different diameters.
- E. The rollers about the top rollers are different diameters.



straw-machine, with exertion, will cut one bushel of chaff per minute." A peculiar advantage, attendant on this machine, is, that it is not liable to be put out of order; and, from the arrangement of its different parts, it will not *choke* or become clogged; a defect justly complained of in the chaff-cutters commonly in use.

Having, in the course of the preceding pages, adverted to the benefit resulting from the feeding of various descriptions of cattle with pease, oats, barley, and other vegetables, when bruised into meal; we cannot conclude this section, without calling the intelligent farmer's attention to Mr. Pasmore's *mill for splitting beans, and crushing barley, oats, &c.* For this useful contrivance, as well as for his straw-cutter, Mr. P. obtained a patent, early in February, 1804; who has also favoured us with an accurate delineation of it. The constituent parts are pointed out in Plate IV. figure 2, and the letters of reference there given.

From the simplicity and durability of its construction, Mr. P's. bruising mill is not liable to be put out of order; while it unites uncommon powers of execution, inasmuch as, "with exertion it will crush one bushel of malt in less than four minutes—beans, oats, barley, &c. in proportion." Hence it promises to become a valuable acquisition, not only to farmers and graziers, but also to brewers and distillers in general; more especially to those residing in the vicinity of large towns, and particularly of the metropolis, where the feeding and fattening of cattle with the grains or refuse of malt is carried on to such an amazing extent. Of the powers of the mill in question, some idea may be formed from the following result of an experiment made with it, by Mr. W. Champion, a respectable brewer, of Sheffield, Yorkshire; who states, that the use of Mr. Pasmore's mill produces an advantage to him of *fifteen shillings* per quarter more than he could obtain by any other method of which he had ever availed himself for crushing malt. It only remains to add, that the ingenious inventor proposes, in the course of a short time, to manufacture these mills on such a scale, that they shall be competent to do as much work in a given time, as can possibly be performed by any four-foot stones.

SECTION III.

PLOUGHS.

PLOUGHS are, perhaps, the most important implements used on a farm ; and, as the soils of farms are necessarily of various natures, so are ploughs diversified in their construction, and the purposes to which they are applied. In the present section, it is intended, to notice only the principal of those which have been invented, and which are, of course, most deserving of attention.

The ploughs in most frequent use, are those denominated *swing-ploughs*, which are not provided with wheels ; consequently they are not liable to be clogged with dirt or mould ; and, being effective implements, they are peculiarly calculated for strong lands, when judiciously guided, as the mould-board is so curved as to make less resistance in turning up the earth ; and, of course, requires a smaller force to draw the implements. Swing-ploughs are in general use throughout Great Britain ; in Scotland they are almost universally adopted, and rarely more than two horses are now made use of. They are yoked abreast, and thus the advantage of their full strength is obtained : for, when yoked one before the other, or harnessed at length, it is hardly possible that they can pull equally. The power of the fore-horses must be exerted, to reduce the traces to a straight line, which cannot be done without pressing on the back of the hindmost horse, where the angle is formed, and consequently greatly distressing him. Hence the superiority of ploughs drawn by two horses (or oxen) abreast, and of single-horse carts. In ploughing also, less time is lost in turning, especially in small fields, where the ploughs are drawn by two horses abreast ; so that they will, with equal ease, do at least one tenth part more work than the same cattle will perform when placed in a line.*

Of the principal swing-ploughs worthy of notice, we may

* Sir J. Sinclair on Scottish Husbandry, Vol. i. p. 72.

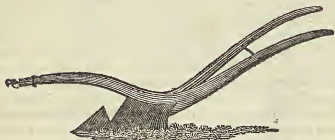
enumerate the following:—1. The *Rotheram plough*, the structure of which is too well known to render any description of its various parts necessary: its simplicity and facility of draught have recommended it preferably to the cumbersome and heavy ploughs formerly used in various parts of this island.—2. *Small's patent*, or *chain plough*,* which is an improvement on the Rotheram plough, the latter being reduced in *size*, and otherwise altered for the better. The most material variation from that in common use, is in the *bridle*, which is at the end of the beam of the chain plough; and which enables the ploughman to give the implement a more effective operation; and also, by means of some holes that are made in the beam, to cut the soil of greater or less depth, as necessity or occasion may require. The wood-work is composed of ash or elm, which renders it peculiarly light and convenient; and though this, as well as the Rotheram plough, (and also a swing plough, which has been recently patronized and recommended to notice by the Board of Agriculture,) are admirably calculated for turning up light soils; yet they are peculiarly adapted for strong tenacious soils, where the progress of the plough is often impeded by stones. These remarks are equally applicable to the Suffolk iron swing-plough; a most effective implement, when judiciously guided, for breaking up heavy and strong lands.

Where, however, the soil is light, thin, and friable, any of the common ploughs may be employed; though these ought to be as light as possible: and, as many obstacles are thrown in the way of ingenious men, who have endeavoured to introduce improvements in agriculture, by the local prejudices of farmers, and especially of labourers, we would suggest it as a remark, that is applicable to every description of ploughs, that great success, and much benefit may be obtained, by adopting the *general* construction of the fashionable, or favourite plough of the country, only altering the proportions, and giving the *operative parts* the requisite cast.

But, with all the advantages which common ploughs possess from the improvements they have received, it not unfrequently happens, that they are choked by an accumulation of stubble,

* In the Appendix to Vol. ii. of the same work, (pp. 23—33.) Sir J. S. has given an interesting account of Mr. Small, and of his improvements in the construction of agricultural implements.

&c. in the narrow angle under the beam, before the coulter, and are thrown out of the ground, by catching small stones between the coulter and the sock. In order to obviate both these inconveniences, Mr. Campbell, an ingenious and practical agriculturist in Kintyre, in the county of Argyle, has altogether thrown aside the *coulter*, and supplied its place by an upright feather, attached to the *land* side of the sock, which serves the purpose of slicing off the furrow, in the same manner as a coulter: and, being laid off on the same angle, it has been used with uncommon success.*



The implement whence this sketch was taken, was on a small construction, and had been chiefly employed in horse-hoeing turnips, beans, cabbages, and other root crops. The weight of the Argyleshire plough is about seventy-six pounds, its cost is stated to be about fifty shillings; and it is manufactured very accurately by Messrs. Brown and Co. of Edinburgh. This implement is, from its lightness and facility of draught, of great general utility, and is peculiarly adapted for taking earth away from the sides of a drilled crop; as its broad upright feather completely shields the plants from all risk of earth falling on them, from the left side of the plough; while, at the same time, the ploughman can ascertain to a certainty, that the part of the implement which is beneath the surface of the ground, approaches no nearer to the roots of the plants than the upper part does to their leaves: so that, if it be necessary, he can bring the plough to slice off the earth close in upon their sides.

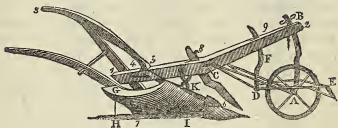
In point of draught, it is precisely the same as the common plough.

* Robertson, in *Farm. Mag.* Vol. iii.

Of *wheel-ploughs* there is a great variety adapted to every modification of soil: and though these are less calculated for the expert than for the inexperienced ploughman, yet (notwithstanding the obstacles presented by their weight and increased difficulty of draught) they deserve to be introduced on stiff and tenacious soils, and, in short, wherever that can be advantageously effected; as they are not easily thrown out of the ground, and at the same time compensate for the additional expense of their cost, by their great expedition in work.

One of the most useful implements of this description, for light soils, is the Norfolk wheel-plough, so denominated from the county where it was invented; the soil of which, being, in general loamy, light, and friable, does not render deep ploughing necessary. It is a light and compact instrument, and possesses great facility of draught: the price of such a plough, we understand, is about from four to six or seven guineas. For light soils also, it has been recently intimated, that the Rotheram, or common swing-plough, may be effectually employed, by simply attaching one or two wheels near to the end of the beam; the requisite variations being made with very little loss of time, or trouble. Nor, where two wheels are made use of, is any holder necessary on lands that are in a good state of tillage, or on a light sward, except at turning out and setting in.

Another valuable wheel-plough is that known by the name of the Beverstone plough; which, if not invented, was at least very materially improved by Mr. Tugwell, of Beverstone, Gloucestershire.



This excellent implement is remarkable for the simplicity of its structure, and its effective operation; it may be drawn with

ease by two oxen, without a driver.—The following are its dimensions:

	Feet.	Inches.
From 1 to 3	6	0
3—4	3	8
3—5	4	3
5—6	2	5
7—6	2	8
1—3 [52]	1	5
1—8	2	10
1—9	4	8
From the heel to the tuck hole of the share . .	2	6½
From the tuck hole to the point of the share . .	0	8½
From A to B	2	4
A—C	2	5
C—D	1	4
D—E	2	5
Diameter of the wheel	1	9
From D to F	0	11
G—H	0	10½
E—I	1	3½
K—L	0	9
Breadth at the heel	0	9
Breadth of the fin	0	7
Top of beam at the heel to the ground . .	0	8½
The mould board projects at the top more than the breadth at the heel	0	6

For breaking up fresh grounds, the improved common, single; and double wheel plough may be employed with effect. The latter is used in some of the midland counties, being drawn by five horses, and attended by one man, in tolerably level soils, which it divides as well as two single ploughs. It is likewise employed, as also is the common single-wheel plough, in Staffordshire, where the latter has recently received an important improvement, by the addition of a *flay*, or iron earth-board, which is firmly screwed to the coulter. The advantage of it is, that in breaking up the turf, the sward is cut off, and turned into the furrow, when it is immediately covered with earth. Thus, by the assistance of one additional horse in the team, the

soil will, at one ploughing, in appearance resemble a fallow, and may be harrowed with nearly equal facility.

On stiff and tenacious soils, no implement is, perhaps, better adapted than the Herefordshire wheel-plough, the share of which is piked; in case, however, of very strong land, the Kentish *turn-wrest plough* is an instrument of great strength, especially where deep ploughing is requisite, on dry, rocky, and hilly situations; as it turns the soil to a considerable depth, and lays the furrow-slice perfectly level, without making any opening in the seam. This implement consists of an oaken beam, ten feet long, five inches deep, and four inches broad: to the end of the beam is tenoned a foot, (five inches thick by three inches and a half in breadth, and three feet and a half long,) which is mortised at the bottom, to the end of the chep. Through the beam, at the distance of two feet five inches from the foot, there passes a sheath of oak, seven inches in width, by one and a half thick, which is mortised into the chep, in an oblique direction; so that the point of the share is twenty-two inches distant from the beam. The chep, to which the share is fastened, is five feet long, four inches wide, and five inches in depth; the share is composed of hammered iron, weighs about thirty-two pounds, is twenty inches in length, and from four and a half to seven inches wide at the point. The upper end of the beam (on the top of which are fixed the handles) rests on a carriage with two wheels, that are three feet two inches high: on the axle-tree is a gallows, whereon is a sliding bolster, to let up and down. Through the centre of the axle is a clasp-iron, to which is fixed a strong chain, called a tow, that comes over the beam, fixed in such a manner, as by means of notches, (or a pin, denominated a *cock*,) to let the plough out to a greater length, and consequently it will penetrate the earth to a greater depth.

Another admirable implement for breaking up stiff, deep, and tenacious lands, is the *double*, or *two-furrow*, *swing* and *wheel plough*; which was, we believe, invented by the late eminent Mr. Duckett, but has received very material improvements and additions from the hand of Lord Somerville, especially in the mould-board. It would, however, lead us into too wide a field of discussion to detail the various parts of this machine without the aid of several engravings; and, unlike the pre-

ceding plough, as it is too complex to be manufactured from a simple description, we shall at present state, that the implement in question is capable of being effectively employed in various situations, though hitherto it has not been tried to that extent, or with that attention which the assiduous regard of its noble improver justly merits. As its name implies, the two-furrow plough produces two furrows *at once*, and appears to be best calculated for light and level soils, particularly for stirring ley-grounds; and, as these cannot be laid too flat, or *seed-earths* be laid too much on an edge, the tool may, by means of the improved mould-board, be easily adapted to either purpose. The chief advantages, however, resulting from the use of the two-furrow wheel-ploughs, are the saving of attendance, (that of one person being altogether dispensed with), and the quantity of work they can do in a given time, which is nearly *double* that performed by common ploughs, with but little addition to the team; though, in strong and stony soils, great power of draught is necessary.

The *paring-plough* is a well-known instrument, of indispensable utility where the practice of paring and burning land is resorted to, as in the conversion of waste lands into a state of tillage; though that practice has, in some cases, been periodically employed on cultivated ground. This implement is so made, as to pare off the surface of the earth to any requisite depth.

The *trench plough* is a skim-coultered plough, invented or improved by the late Mr. Duckett, already mentioned. It is furnished with two shares, one directly over the other; so that one narrow, superficial furrow, may be drawn from the surface of the ground, while another is taken off beneath, at a moderate depth. The trench-plough is admirably calculated for ploughing in green crops, or long muck, by way of manure; whatever is thus turned in being really covered, so that the surface is entirely cleared from all weeds, and fit for the reception of any succeeding crop. Further, should the surface of the soil be *foul*, it may be turned under, and fresh soil brought up from the depth of ten inches, by employing the force of three horses; thus, the earth being loosened, the roots of plants are enabled to strike downward without encountering any obstruction; and, while the ground is drained of superfluous moisture, it is

exposed to the influence of the air, and consequently greatly ameliorated.

To the list of ploughs for breaking up stiff, clayey lands, may be added a strong, effective implement, called a *miner*, from the circumstance of its opening, or rather *loosening*, soil to a great depth. It has simply a share, without any mould-board or plate whatever; and may be advantageously employed for eradicating those weeds which take deep root. The price of a *miner* is about three guineas.

Drill-ploughs.—Since the new or drill husbandry has been generally adopted, numerous drill-machines have been invented, and which possess various degrees of merit.

This useful implement was invented by Jethro Tull, a man whose talents and ingenuity, ever devoted to the welfare of his country, will be held in grateful remembrance so long as agriculture is considered as a primary object of attention. Since his time, various improvements have been made and suggested; among those more deserving of notice are, 1. Mr. Young's, which is asserted to be calculated for the stiffest soils, and to deposit seed in drills cut through clay-fields, without any previous ploughing ("Annals of Agriculture," Vol. iii.).—2. Mr. Amos's *drill-plough* is stated (in his treatise, entitled the "Theory and Practice of Drill-husbandry," 4to.) to sow any kind of seeds, in any quantity, at any required depth, and to perform its business expeditiously, and with facility of draught. 3. Mr. Cook's improved drill is a useful implement, which has been found to answer the purpose on dry soils, and in some cases with equal advantage on strong, clayey, and loamy lands.* The price of this implement, with its corresponding tools, is, we understand, about £40.—4. Several useful improvements and alterations in drill-machinery have been suggested by the late Dr. Darwin, and also by Mr. Swanwick, of Derby, ("Phytologia," 4to, p. 608, and foll.); all of which contrivances being too complex for description, to convey any correct idea of them, we trust this notice of them will be sufficient. We pass them, therefore, omitting numerous common drills, which have been found to answer their respective pur-

* The minute account of this machine, and of its application, has been published by Mr. Cook, in a small tract entitled, "Drill-Husbandry perfected," 12mo.

poses very well, and proceed to notice two drill-machines of recent invention, the simplicity of whose mechanism—(and simplicity is, in the present case, of primary importance)—facility of working, and comparative cheapness, render them more worthy of general notice.

The first of the implements alluded to is, the Rev. Mr. Munings's *turnip-drill*, for the invention of which he was (in 1801) honoured with a premium by the Society of Arts, ("Transactions of the Society for the Encouragement of Arts," &c. for 1801); and of which the annexed figures will convey an adequate idea.

Fig. 1.

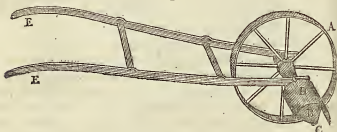


Fig. 2.



The machine consists of a barrel-shaped box, that is fixed to the axis of a wheel, about twenty-two inches in diameter, and vertical with such box; during its revolutions, it deposits the seed through certain openings in the middle of the barrel, that are about fourteen inches apart.

Fig. 1. A represents the wheel, with an iron rim.

B is the tin barrel, or seed-box, that is fixed to the axis of the wheel; C the aperture through which the seed is introduced into the box, and which opening is afterwards closed with a cover.

D is a semi-circular tin plate, intended to remove all impurities and extraneous matters from the seed-box.

The letters E E denote the two handles of the implement.

Fig. 2. F describes the seed-box B, on a larger scale; G the holes in the tin barrel, or seed-box, through which the seed is dropped upon the soil; H represents that part of the wheel's axis, to which the seed box is attached.

In his communication to the respectable Society above named, the inventor considers this turnip-drill to be greatly superior to any former machine, from the circumstance of its depositing seed so immediately after the plough, as to preserve all the good effects of the first evaporation, which, in his opinion, is greatly conducive to the vegetation of minute seeds. Thus, in six acres of drilled turnips, there was not a deficiency of six square yards: whereas, on half that quantity, or three acres broad-cast, before rain fell, not *one-half*, perhaps not one-third, of the seed vegetated.

Fig. 1.

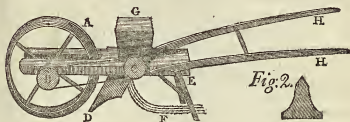
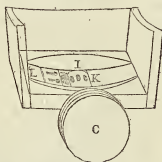


Fig. 3.



These figures represent Mr. Knight's *improved drill-machine for sowing turnips*, for the invention of which he was also

honoured, in the same year, and by the same Society, with a silver medal.

Fig. 1. A is an iron wheel, which, running on its edge, formed by two concave sides, makes the groove in which the seeds are deposited.

B is a wheel which moves on the same axis as the wheel A, and which, by means of a strap, turns another wheel, C; that gives out the seed.

D is the tube through which the seed falls into the channel made by the iron wheel A; E the feet of the machine.

F represents six lengths of a jack-chain, which Mr. K. has found to cover the seed perfectly, and conceives to be preferable to any harrow, as it cannot be impeded in its course by the loose straw that often occurs on the surface of recently-manured lands.

G the seed-box; H H the handles of the implement.

Fig. 3 is a delineation, on a larger scale, of the seed-box G, fig. 1. The wheel C is the same in both figures; it is fixed on the axis of the cylinder I, the surface of which is pierced with holes, described at K, for dropping the seed. This cylinder revolves within a groove at the bottom of the box, to which it is so firmly fixed as to admit the passing of no seed, unless it be delivered by the holes K.

L is a *strickler*, or small brush, that rubs against the cylinder, for the purpose of dislodging any seeds that may remain in the holes. The seeds fall into the tube beneath the cylinder, from which they are conveyed into the furrow, or channel, made by the indenting rim of the iron wheel A, and are then covered with soil by the loose jack-chains F.

Fig. 2 is a front view of the wheel representing its edge; the angle which forms that edge must be made more or less acute, and the machine be made proportionably strong, according to the stiffness or lightness of the soil. Mr. K. states, in his communication to the Society of Arts, that he has occasionally added leaden weights over the axis of the wheel, but adds, that they will be seldom wanted; as he has tried the implement on various soils, and with equal success. And as the delay of a few days often materially affects the future growth of a crop of turnips, great benefit may be derived from the use of this machine, at a time when the teams are occupied with other farm business.

The labour of using Mr. Knight's drill-machine is so easy that one man may, upon an average, drill four, or sometimes more statute acres in one day; the rows being eighteen or twenty inches asunder, and the plants six inches distant in each row. It will, however, be proper either to harrow the ground across or to roll it, before the implement is used, that the labourer may see the rows he has made; but Mr. K. observes, that he always found the crop succeed better after being rolled than after the use of the harrow, even in very strong lands. We have been thus, we trust not unnecessarily, diffuse in describing the two machines last noticed; as, independently of the simplicity of their construction, they are obviously capable of being applied to the drilling of other seeds than those of turnips, by varying the proportions, or enlarging the apertures, of the seed-box, as circumstances may require.

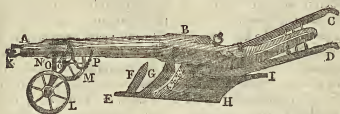
Lastly, there is a simple machine, denominated a *hand-drill*, or drill-barrow, which is well calculated for distributing small seeds. The principal part of it is a wheel, about twenty-two inches in diameter, and made of solid deal, on the axle of which is fixed a notched roller, two inches and three quarters in diameter, and two inches in length, that turns in the fore part of the drill-box. The quantity of seed to be distributed is regulated by a slider, which moves upward and downward in the fore part of the box, by means of an adjusting screw fixed at the top, and has a strong brush, or strickler, that projects from its lower end, and sweeps upon the notched roller. There is also a sluice, or slider, which lies flat on the bottom on the inside of the drill-box, and projects between the two handles of the drill, so as to be within the reach of the person guiding it; who, pushing the slide forwards, thus perfectly covers the notched roller, and prevents any seed from being dispersed while turning the drill at the end of the ridges. With this machine, it is said, a *woman* or *boy* can drill from two to two acres and a half in one day, the rows being twenty inches asunder. The implement here described is much used in the lowlands of Scotland; but, as it sows only one row at a time, much advantage would be derived, in point of dispatch, and especially in the saving of labour, if it were constructed so as to drill several rows at the same time, and the apertures also made capable of being regulated with regard to the distances for putting in various seeds.

Having thus described the most important ploughs in use for the more general branches of husbandry, we proceed to notice those which are more peculiarly calculated for affording assistance in the drainage of lands.

One of the most useful ploughs, of this description, is the *mole-plough*, invented by Mr. Adam Scott, who was, in 1797, honoured with a premium by the Society of Arts. It is composed of a coulter that is fifteen inches long, by two and a half wide, for the purpose of cutting the sward; behind this coulter is fixed a horizontal, cast-iron cone, twenty inches in length, and two inches and a half in diameter at the base; to the middle of which is fastened an upright bar, two feet in length, and three inches and a half in breadth, with a sharp edge. In pleasure grounds, and other situations, where the surface of the land is an object of regard, this plough will be found very useful for making temporary drains, as the mark made by the coulter speedily disappears. A man and boy, with four horses, may, it is stated, with ease, drain thirty acres a day; it will, however, be necessary, in using this implement, to make an open ditch at the lower side of the ground intended to be drained, for carrying off the water from the furrows or drains, which should be formed at the distance of ten or fifteen feet, in straight lines. And it is suggested, that in very wet lands, or seasons, it may be advantageous to employ eight, nine, or a larger number of horses; because, each animal drawing less, the feet will not sink so deeply into the ground. The expense of this implement (in 1797) is stated not to exceed two guineas and a half.

This implement has received some improvements from the hand of Mr. Watt, who obtained a patent for the same in 1797. The most material alteration is, that Mr. W. has applied a cast-iron, or steel, rolling cutter in the beam of his draining-plough, instead of the *coulter* which Mr. Scott has fixed in the usual manner by means of wedges; three cutters are also added, for the purpose of being occasionally substituted for the rolling cutter. In drawing this implement, which is much used in the midland counties, from four to eight or more horses will be necessary, according to the nature and depth of the ground intended to be drained. For general purposes, the common draining-plough, which is too well known to require minute description, is an effective implement.

The latest drain-plough, which deserves more particular notice, is that invented by, or under, the direction of the late Duke of Bridgewater, and which is delineated in the subjoined cut.



A B represents the beam of the plough.

C D are the handles.

E is the *sock*, or share.

F is the coultter, or first cutter of the sod, which is attached to the share.

G is the second cutter, or coultter, which separates the sod from the land, and forwards it through the open space between F and G. This second cutter is connected with the share, and also with the beam.

H I the sheath of the plough.

K is the bridle, or muzzle, to which the swingle-tree is fastened.

L M two cast-iron wheels, which may be raised or lowered by the screws N pressing on the flat irons O O, to which the axis of each wheel is fixed. The object of these wheels is to regulate the depth to which the share is to penetrate the soil.

P is a chain, provided with an iron pin for moving the screws at O.

In his communication to the Society for the Encouragement of Arts, &c. ("Transactions," Vol. xix.) the Duke of Bridgewater observes, that the best time for making use of his implement is about Michaelmas, or immediately after the grass is eaten off; between which period and Christmas the whole operation ought to be completed. On clay soils, that have never been drained, six horses will be requisite to draw this drain-plough; but, in succeeding years, four horses may, or will be necessary, to draw it through the same furrows or gutters. In

stiff, flat lands, the implement cannot go too deeply into the ground; though, on declivities, five inches will in general be sufficient; but, on soft and light soils, it ought to be directed as deep as possible, as the sides are apt to crumble and fall into the gutters.

Before we conclude the subject of ploughs, it may not be altogether irrelevant to state, that a useful contrivance was suggested by the late Mr. More, (many years Secretary to the Society above named), for the purpose of ascertaining the force necessary in the draught of various ploughs. It consists of a spring coiled within a cylindrical case, which is provided with a dial-plate, numbered in the same manner as that of a watch or clock. It is so constructed that the hand moves in consequence of the motion of the spring, and points to the number according to the force exerted; so that if the draught be equal to one hundred weight over a pulley, the hand will be directed towards the figure 1; if it be equal to two hundred weight, the hand will point to the figure 2; advancing or diminishing according to the exertions made.* There is also a contrivance for measuring draughts, invented by Mr. Salmon, whom we have noticed in the preceding section; but, not having seen this piece of machinery, we cannot state the principles on which it is constructed.

SECTION IV.

SCARIFIERS AND HOES.

SCARIFIERS and Scufflers are implements which have only been employed within a few years. Their size and form are various; and, as it would be impossible to convey an adequate idea of their construction without the aid of numerous engravings, we shall only notice concisely those held in most esteem. Such are Mr. Cook's scarifier and scuffler, which form part of his drill-machinery, the full price of which is 40*l.*—Mr. Lester's *cultivator*, who (in 1801) obtained a silver medal from the Society of Arts for his invention, the merit of which has, how-

* "Annals of Agriculture," Vol. i.

ever, been contended, it having been asserted to be known long since in North Britain, under the name of an *edget*—(“Farm. Mag.” Vol. iii.)*—Mr. Hayward’s *extirpator*, or *scalp-plough*, which is a useful implement of the kind, and well calculated for destroying weeds, and clearing land for the reception of seed. It consists of a beam seven feet long, which is furnished with two handles; the shares are eight inches broad, nine long, and are fastened to *stalks* about ten inches high, and eleven inches apart. It possesses the advantage of being fixed to the wheels of a common plough; does much work in a short time; as it may be worked by any person capable of directing a plough: and will turn over one acre an hour without fatiguing the teams, which should consist of two, three, or more horses, according to the nature of the soil.—Mr. M’Dougall’s (Oxford Street) scarifier, of which the annexed cut has been made from an original drawing,



is a cheap and effective implement, that has been employed with great success.

* The cultivator has been simplified in Scotland by Mr. Dudgeon of Broom-House, East Lothian, by whom it has been adapted to the most valuable purposes of agriculture. It is now termed a *Grubber*; and its operation is thus described in a communication made to Sir John Sinclair by its improver.

The Grubber “is successfully used for turning up any couch or other noxious weeds, whose roots may be turned down by ploughing. When a field has just been ploughed, harrowed, and gathered, the farmer finds a great proportion of the couch, &c. turned down, out of the reach of any common harrow; and, if practicable, would plough it again to hasten the process of fallowing; but *that* he cannot do without neglecting his other fields. In this case, therefore, he has recourse to the grubber, which effectually accomplishes his wishes in raising every thing to the surface. When this object is attained, harrowing and gathering are again successfully em-

The practice of *scarifying* grass lands, indeed, is of late date; but, where the beauty of the lawn is not regarded, it is very beneficial, as it conduces greatly to increase the quantity of hay by loosening the surface, so that the roots have fresh power of vegetation. The use of the scarifier is particularly advantageous before the laying on of manure; under the old practice of *rolling*, which is asserted to render the surface hard and tenacious, much difficulty was incurred in order to get the manure below the surface to supply food for the roots; on the contrary, by the careful use of the scarifier, this inconvenience is completely obviated, by the ground being opened, so that the roots immediately receive whatever quantity of manure may be laid on, by which means a saving in that important article is effected, as a small quantity, so applied, goes as far as a much larger proportion strewed after the old practice.

Hoes are useful tools, which have long been employed both for garden and field culture. They may either be used by hand, or drawn by *horses*. In the latter case they are called *horse-hoes*, and are well calculated for hoeing drilled crops: of this description are, 1. The tool invented by Mr. Amos, which has moveable shares, so that it may be varied according to the distances at which the seed may have been drilled: and, 2. Mr. Cook's *horse-hoe*, forming part of his drill-machinery; as, however, his shares are fixed, this circumstance, perhaps, renders his implement, though otherwise an admirably effective one, less eligible than the former.

ployed, and thus a constant succession of important labour is accomplished in a much shorter period than was ever done before. In light lands, if the ridges are once properly formed to the mould required, the grubber is capable of cleaning the land effectually, with no other ploughings than what are necessary for covering the manure which may be ultimately applied. But in the case of a strong soil, it is necessary to have it more pulverised by a few ploughings, before this implement can produce its proper effect. When it is required to level ridges by cross-ploughings, nothing can exceed the grubber for that purpose. In all cases it requires four horses; but, except there is much rough sod upon the field, or an uncommon quantity of couch-grass, only a steady and attentive driver is required, and never more besides the driver, but a boy with a plough-staff in his hand to push away any thing that is likely to occasion any interruption to the prosecution of the work."—Sinclair's Husbandry of Scotland, Vol. ii. (Appendix) pp. 163—166. The price of this effective implement in Scotland is from £8 to £8 8s. (and, if it be made very strong, about £11 11s.)

* Among the various hand-hoes that are deserving of notice, those invented by the late Mr. Duckett are eminently useful in mellow soils. He has availed himself of a short handle, towards the bottom of which is an iron ring, or loop, for holding a strap that is fastened round the waist of the labourers as they walk backwards. This circumstance, together with the heavy iron work, gives the implement much power, and renders it very effective.*

The *scuffle*, or *Dutch hoe*, is used principally in cutting up weeds, and loosening the soil around esculent plants. It is of various sizes, each being fixed on handles from five to six feet in length; and the cutting plate, which is seven or eight inches wide, being open in the middle, that the earth and weeds, in hoeing, may fall through the open part without impeding the operation.

Another useful implement, of this description, is the *prong-hoe*, which is chiefly used for the purpose of hoeing or breaking the ground, near or among the roots of plants. It consists of a handle, five or six feet in length, to which are attached two hooked points, six or seven inches long; when stricken into the soil it will stir and turn it to the same depth as a plough, thus answering both intentions, viz. that of opening the ground, and of cutting up weeds. The prong-hoe is an effective implement, particularly in horse-hoeing husbandry, when the plough can only come within two or three inches of the rows of vegetables; as, by means of it, the land may be stirred to the very stalk of the plant.

The next implement belonging to this class, which is more peculiarly worthy of notice, is Mr. M'Dougall's *improved hoe*, represented in the subjoined cut.

It consists of two principal parts; the first of which is a beam of wood, having at its fore-end a semicircle that forms two handles, between which one man



* See "Communications to the Board of Agriculture," Vol. ii. in which is given an engraving of Mr. D's hoe. Similar implements have long been used in Portugal for hoeing the vineyards situated in strong soils; they are forcibly recommended to the notice of British agriculturists by Lord Somerville, in his "System followed during the two last years by the Board of Agriculture," &c. 8vo. 1800.

walks and draws the tool forward. At the other end, this beam is divided, and moves on two small gudgeons, by which it is accommodated to the height of the hands of the person drawing, and room is allowed for the movement of a wheel. The further end of the opposite beam is held by another person, who guides the hoe, and regulates the depth to which it enters the ground, at the same time assisting its action by pushing it forward. The fore-end of this beam is likewise divided, so as to admit a wheel to run between the sides, which serves to regulate the depth, and at the same time to ease the draught in working this instrument.

The hoes, or cutting plates, are made of cast iron, and mortised in the hinder beam by means of a proper wedge; their size and dimensions may be varied according to the peculiar nature of the work: the object of this very effective implement is, to eradicate weeds from land, and to loosen the soil in the intermediate spaces of pulse, or grain sown in equidistant rows, while the plants are, at the same time, properly earthed up, and consequently vegetate with increased luxuriance.

Notwithstanding the implements already noticed are sufficiently well calculated to answer the purposes for which they are designed, it has been suggested, that the operation of hoeing may often be performed with advantage on higher soils, where the intervals between the rows are tolerably wide, with any small plough of the common construction, having a sharp and broad share. Dr. Anderson has suggested the use of a double mould-board plough for this purpose; and, in the second volume of his interesting "*Recreations in Agriculture*," he has given a minute of the successful practice of this method, which is stated to be peculiarly adapted to the clearing of weeds, &c. from cabbages, round which the earth is heaped, so that their vegetation is greatly promoted. It appears, however, that double mould-board ploughs cannot be effectually employed with this intention, on lands under the drill husbandry, on account of the difficulty attendant on the adjusting of the shares to the width of the rows, which sometimes varies a little. Hence, notwithstanding such variation may not exceed one or two inches, the work is of necessity incompletely done, as the mould cannot be properly raised around the roots of the plants; so that a small common plough, as above

mentioned, may be preferably employed to a double-breasted instrument.

We cannot, however, omit in this place to notice a valuable horse-hoe, invented a few years since by the late Mr. Duckett. It is made entirely of iron, including the carriage, and is composed of two common plough-shares, which work from twenty to twenty-four inches of ground in breadth, in proportion as they are winged. These shares are fastened, by means of wedges, into a twisted beam, and the whole is put together with such solidity and strength, that the implement may be worked with four horses at any requisite depth. These hoes are chiefly calculated for clearing bean and pea stubbles for the plough, which purpose they attain with such effect, that it is stated the land may be sown, even although the ground may not have previously been ploughed.

A very valuable "*turnip-hoe*, or more properly turnip-chopper," has been recently introduced to the notice of the farming public by Mr. Malcolm, ("*Compendium of Modern Husbandry*," Vol. i.), which deserves to be adopted in every district where the feeding of cattle constitutes a primary object of agricultural labour.—"The hoe is first made like the common nine-inch garden-hoe, forming an oblong square, with an eye to receive the handle: from the centre of the first hoe, another hoe crosses it at right angles; but this second hoe is not made solid as in the first common hoe, but is made like a Dutch hoe, the centre-part of it being open the whole length of it. The turnip being pulled out of the ground by the angles of the hoe, is immediately struck with it about the centre, which divides it into four; and, if these four pieces are not small enough, the stroke is repeated upon each of the pieces, until they are sufficiently so." This implement will be found very useful; but Mr. Malcolm is of opinion, that it would be greatly improved "by having two stoutish prongs on the back or reverse part of the hoe, proceeding from the neck of the eye: these prongs would pull up the roots with infinitely more expedition; and the increased weight of the hoe would rather be in its favour, by lessening the force necessary to split the roots. "The whole expense," he adds, "is so trifling, and the simplicity of it is such, as greatly to enhance its value."

This very valuable implement appears to have been first

used on the farm of Mr. Street, of Bramley, in the county of Surrey; by means of it, the shepherd may take up the turnip, and slice it by one or more strokes, into as many divisions as, according to the size of the root, each piece may be sufficiently small either for lambs to take into their mouths, or (which is of more immediate consequence) to enable the *crones*, or old toothless ewes to fatten with nearly equal facility as the young ones do; as they are capable of picking up these pieces, and by a toss of the head can throw them into the further part of the mouth, to the *gruders*. Thus they are enabled properly to masticate the root, when they would otherwise find it very difficult to supply themselves with a sufficient quantity of food; by the usual method of nibbling the turnip, either while it is in the ground, or after it is picked up. It only remains to add, in affirmance of its value, that the state and condition of Mr. Street's sheep, both ewes and lambs of all ages, were beyond all comparison superior to those of the same sort, in the same neighbourhood, where the turnip-hoe was not employed.

A useful contrivance has been invented by Mr. Parkinson, an ingenious and practical agriculturist, ("Experienced Farmer," Vol. i.) for the purpose of eradicating tap-rooted weeds, which often resist the action of the scarifier, when its edge is blunted, so that they are dragged down, and continue to vegetate. This, too, is asserted to be superior to the scarifier, or plough, for such purpose; but can only be employed on light land, where the fallow is well broken, and nearly clean of twitch or couch. Mr. P's implement is of a triangular form, having a beam, beneath which are two small wheels to run before it, in the same manner as in the Norfolk plough. There are three coulter, under each of which is riveted a share, about fourteen inches in width, and the point of which is made sharp like a fleam. These coulters penetrate to the same depth as a plough; and, without materially moving the soil, cut up thistles and other weeds much better than any other implement which has hitherto occurred to his notice. And, in case those weeds are very numerous, Mr. P. employs a beam with one wheel, into which he puts one of the coulters, to cut between the rows of the drills. This *extirpator*, (for so we think it may with propriety be termed), will penetrate to any depth that may be required; and that which is provided with three shares

will, according to the inventor's statement, do as much work in one day as three ploughs.

SECTION V.

HARROWS

are implements of essential importance in the management of farm lands, not only for the purpose of covering the seed with earth, but likewise for pulverizing the soil, previously to its reception of seed.

The most simple instrument of this description is the *bush-harrow*, which is chiefly used for the purpose of harrowing dung or seeds into grass lands. It consists simply of a frame, the fore-part of which is raised by means of two wheels, and into which frame some sort of bushes are interwoven.

The most common harrow is the *brake*, a large and weighty instrument, employed in reducing stubborn soils, and for other purposes. It consists of four square bulls, each side being five inches thick, and six feet and a half long; the teeth are seventeen inches in length, and bent forward in the manner of a coulter; four of these teeth are inserted in each bull, being fixed above with a screw nut, having twelve inches free below, with a heel close to the under part of the bull to prevent it from being pushed back by stones. Four horses, or oxen, are necessary to draw this apparatus, which is eminently calculated for pulverizing stiff clays. *Round* iron teeth are preferable, for every sort of harrow that may be used; as they keep themselves cleaner than those which are square, or of any other shape, and also work easier after the horses.*

There are other harrows in common use for harrowing ground, which are of a lighter construction, and of which two or a larger number, are usually chained together; and though they in general answer that purpose sufficiently well, they are nevertheless often liable to be thrown out of work by stones, while much time is necessarily lost in turning at the ends of ridges. This inconvenience has been attempted to be obviated

* Sinclair's Husbandry of Scotland, Vol. i. p. 76.

by adopting running bulls, which expedient has been found to succeed. A better mode, however, is to couple the implements together by means of stout hooks and eyes, so that the different harrows rise and fall at the same time without hitching on each other, or requiring the driver to stop at each turn in order to rectify them.

The improvement of harrows has, only within a few years, become an object of particular attention; and, notwithstanding much has been done in a short period for their better construction, they are yet but in a comparatively imperfect state.

One of the most improved harrows, by which the inconveniences above noticed are removed, is Mr. Lester's, who obtained a patent for his invention in the course of the year 1799; and although its structure cannot be detailed without the aid of an engraving, yet we think it will not be altogether useless to state a few particulars, which distinguish this instrument from those in common use. The patent harrows are of various sizes, so that they may be drawn by one, two, or more horses, and may suit every kind of soil; single-horse harrows, however, are preferred by the most intelligent agriculturists to such as require a larger draught. The first size of Mr. Lester's apparatus is six feet wide, and of equal length; the teeth are twelve inches asunder in every direction, and there is an intervening space of one inch and a half between their track in the line of draught. This size is peculiarly adapted to the harrowing-in of seed on *lay*, *flag*, or *whole* land. The second size is seven feet and a half in width, by six feet nine inches in length; the teeth are fourteen inches distant in every direction, and there is an interval of two inches between their tracks in the line of draught: it is eminently calculated for cleaning foul lands. The third size is nine feet long, and seven feet nine inches broad; the teeth are sixteen inches wide in every direction, and there is an intermediate space of two inches and a half between the tracks in the line of draught. This implement is stated to be superiorly adapted to the culture of foul ground, and particularly for eradicating couch-grass from *fen-fallows*. As the chief defect in common harrows is their liability to be clogged, so the primary excellence in the patent harrow is the impossibility of its being clogged, or driving the land together in heaps. Being divided into two parts, of equal length, "which are drawn by two centres united in a third," its motion is

steady and uniform, and the machine cannot diverge into any oblique direction. Further, the patent harrow yields to all the inequalities of the soil, and *couches* over ridges and furrows, so that much time is saved in turning; while, from the diagonal arrangement of the bulls, and the irregular position of the teeth, each tine or tooth is drawn into a different direction; hence no one can follow another in the same track, and consequently the object required of harrows is more completely effected.

An improved *iron harrow* has been constructed under the direction of Mr. Young; it consists of two iron frames, in which the teeth are diagonally disposed, so that no one tooth can follow another in the same track. In order to give the apparatus greater steadiness and uniformity, each tooth is screwed through a double frame, separated by iron washes; and it is supplied with handles (an *indispensable requisite* in the construction of harrows), for the purpose of lifting up or pressing down, as circumstances may require; so that no impediment can arise from lumps of soil, or tufts of weeds, being dragged along. A harrow of this description costs from six to eight guineas; it is much superior to the common wooden ones, both for *effective work*, and also in point of durability.

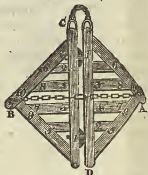
In 1795, Mr. Knight submitted an improved harrow to the inspection of the Society for the Encouragement of Arts, &c. by whom he was honoured with a premium. Its object is to prevent loss of time when turning at the ends of ridges; and being furnished with wheels to diminish the draught of horses. This design is certainly effected; but as his machine appears to be too expensive, (though such expense may be lessened, according to the inventor's statement, by constructing the axle-tree and joints of wood), and also rather too complicated to be generally adopted, we pass, therefore, to notice two or three harrows of more simple make, and which seem to deserve more general attention.

In the course of the year 1801, Mr. Wilde obtained a patent for a newly-invented harrow, which possesses a considerable degree of simplicity. When put together for work, the *set* consists of four harrows, which are constructed in the usual manner, and with the usual number of teeth. These are placed in a direction nearly parallel to each other, and are united by means of three iron links, which are moveable at the part where they are joined to the harrow. The centre link is *obliquely*

fastened, and is longer than the two others, which are set *straight*; but all the links are disposed loosely, in order that the implement may have room to *play*. This harrow, or rather series of harrows, is fastened to the *bearing bar* (to which the traces are attached) by an iron pin, which is affixed to the chain hook, passing through holes made at various distances in the bar, so as to give the exact direction to the machinery; in consequence of such arrangement a uniform course is obtained, and the work is regularly performed. These patent harrows may be constructed of any requisite size; and the horses may be placed so as to draw a-breast; or, in case the land be wet and heavy, to follow each other in the same track in the furrow, and thus prevent the soil from being poached.

One of the simplest, and, in our opinion, most effective instruments of this description is the *chain and screw harrow*, invented a few years since by the Hon. R. Sandilands, which is represented in the annexed figure, and from which any ingenious mechanic, may, we think, construct an implement.

Where the ridges are high, and it becomes necessary to harrow them through their whole extent, the *chain and screw harrow* is eminently calculated for service; for, by lengthening the chain, which is commanded by the screw, the harrow will, when drawn along, form an angle downwards, and thus pass over every part of the ridge, according to its extent. This, as appears from Mr. S's account, ("Letters and Papers of the Bath and West of England Society,") may be nine feet, the distance from A to B in the figure above delineated; on the contrary, the whole space from C to D is stated not to exceed five feet and a half. After the crowns of the ridges have been sufficiently harrowed lengthways, the chain may be contracted, or shortened, by the screw, which forms an angle upwards. The harrow is then drawn by horses, one on either side of the furrow, which will be completely reduced, as also will the sides of the ridges, if eighteen feet broad. Where the harrow is to be drawn over level or even ground, or over high ridges, it may, by means of the screw, be made horizontal, so as to work like a solid harrow without a joint.



The tines, or teeth, in the apparatus above described, are square, and fixed in the usual manner, being nine or ten inches below the wooden framé, and made of such a degree of strength as the nature of the land may render necessary. They tear or cut the soil uniformly every four inches, without being clogged by weeds, &c. except at the extreme angles, where the teeth are of necessity disposed somewhat closely together; but this inconvenience may be easily obviated, and the teeth cleared, by elevating them a little from the ground. The figures 1, 2, 3, 4, 5, 6, 7, 8, &c. &c. denote the parts where the twelve teeth are to be fixed on each side of the harrow. But, where the situation or nature of the soil is such as to render a strong brake-harrow unnecessary, by making the tines shorter, or lighter, forty-eight teeth may be obtained, which will tear the ground at every two inches, effectually cover the seed, and at the same time produce a fine mould. Mr. S. also recommends the construction above specified to be adopted in harrows of every size, and for every purpose; as from the peculiar arrangement of the tines, no one tooth can follow in the same track with another, while all are kept in constant action.

Lastly, the same gentleman has submitted to public inspection an effective instrument, which he denominates a *wrack-harrow*, from the speedy manner in which it collects together the *wrack*, or roots of couch or twitch grass, and other troublesome weeds, after they have been brought to the surface. This contrivance consists of a plank of timber, six feet in length by nine inches in breadth, and two inches thick; in which there are fixed two rows of teeth, the front row containing twelve, and the back row thirteen tines. Each row is about four inches asunder; and the teeth in each row are five inches apart, so as to work at two inches and a half distant from each other. The tines, or teeth, are about seven inches long below the wood, three-quarters of an inch square, and pointed *diamond-wise*; hence they do not penetrate the land, but only catch whatever may have been brought to the surface by previous harrowing. To the plank are affixed shafts for a single horse to draw the implement, and handles for its guidance, of such size and strength as may be deemed necessary.

In order to employ the *wrack-harrow*, after the *wrack* or roots of weeds are brought to the surface, it is drawn across the field, the person who holds the handles pressing on them a

little, till the plank has passed over the first furrow, when the instrument is suddenly lifted while the horse is going on; all the weeds thus collected fall into the furrow, where they may be burnt, or removed thence, as the farmer may decide. But, in case the horse is unsteady, it will be proper to have a boy to lead him, otherwise the work will be imperfectly performed.

In 1811, the Society for the Encouragement of Arts, &c. conferred their silver medal on Mr. W. Jeffery, of Cotton End, near Northampton, for his invention of a pair of expanding harrows, applicable both for cleaning foul land, and also for harrowing in seeds. These harrows, instead of being mortised through each other at each intersection, as in the common way, consist of cross-bars, in which the teeth are fixed, united to length bars by means of a spindle running through both bars; consequently, by means of an adjusting diagonal bar of iron, with holes for pins, the shape of the harrow may be varied, and the teeth be fastened so as to work at any requisite degree of extent.

The point of improvement in these harrows consists in their power of contraction or expansion, so as to cover an extent of land from five to ten feet: their teeth may be set at twelve different distances from them, and their tracks will always beat equal distances, according to the state of the land; and they will either serve for harrowing in seeds, or cleaning foul land. For the latter purpose, Mr. Jeffery's harrows are stated far to exceed any other yet made; one pair of them will answer the purpose of three or more pairs made upon the old construction. Hence it will be evident, that this implement has a powerful claim to attention: for in addition to the preceding facts, it is stated in the certificate of some respectable farmers, addressed to the above-mentioned Society, that—independently of their facility in being contracted or expanded (which, it appears, may be done in two or three minutes), these harrows are much stronger and more durable than any other; as there is no mortise or tenon to weaken the wood-work, or to harbour wet; and, further, that they will fold up in a small compass, and will admit of being removed from place to place with far more facility.*

* Transactions of the Society of Arts, Vol. xxviii, pp. 51—54, where an engraving is given of Mr. Jeffery's harrows.

SECTION VI.

DRAGS.

THESE implements are somewhat like scarifiers, and are employed for the same purposes: their construction varies greatly in different counties, so that any description would not contribute to convey any accurate idea of them. The common drag is chiefly used; but like all other machinery, it is capable of improvement. Mr. Parkinson recommends the *duck-footed drag*, as being more effective, and consequently preferable to any other; particularly if the teeth be *wedged*, instead of being *screwed* into the wood, so as to admit of their being easily altered and set to any depth that may be required.

SECTION VII.

ROLLERS.

ROLLERS are differently made, of wood, stone, and of cast iron; and of various sizes, according to the respective purposes for which they are used. The common rollers are from fifteen to twenty, and thence to thirty inches in diameter, about six feet in length; they are generally used for rolling pasture-lands.

In constructing these instruments, it will be advisable to make the cylinder of a small diameter, not less than twelve, nor more than thirty inches in diameter, as the degree of pressure necessarily decreases, if it rest on too large a surface at one time, unless an additional weight be put on the *frame*. This part of the machine ought, therefore, to be very strong; though it will be preferable to place open boxes, or small cars, upon the frame for such purpose, which will, at the same time, serve to receive any substances that may be picked off the soil. Should, however, the land be stiff, and difficult to reduce, the addition of *spikes* to the roller will prove of essential utility in bringing the earth to a fine tilth. In Scotland, Aberdeenshire

granite has been found preferable to every other material for rollers, being much cheaper, infinitely more durable, and so weighty, that it may be made of as small a diameter as is necessary.*

SECTION VIII.

CHURNS.

THE structure of the churns in common use is too well known to require any description. The tedious manner in which butter and cheese are made by them, having induced several practical mechanics to invent others, which are less expensive, and more speedy in their operation, we have selected two that appear more worthy of notice.

The *first* is the churn manufactured by Messrs. Wright and Co. of Philadelphia, and which is represented in the subjoined cut.

Fig. 1.



Fig. 2.



It is made in the form of a cube, with vertical dashers, as delineated at *a, a, a, a, a, a, a, a*. *B* is the top, which takes off. *C* the spindle, or handle, that passes through and turns the

* Sinclair's Husbandry of Scotland, Vol. i. p. 164.

dashers, *a, a, a*, &c. D D D D describe the form of the churn each way. From this mode of construction, considerable power is gained, and much time saved in working the churn, which is a simple and effective contrivance.

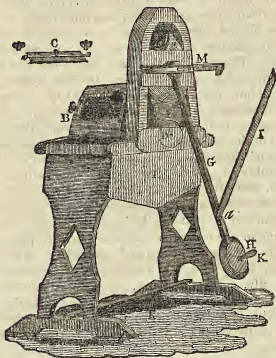
The *second* is Mr. W. Bowler's *improved churn*, which, in 1795, was honoured with the notice of, and a premium by, the Society for the Encouragement of Arts, &c. already mentioned in the course of this work.*

Mr. B's improved churn is of the barrel kind, being a cylinder, eighteen inches in diameter, and nine inches wide. The sides are of wood, though we conceive tin would be a better substitute, on account of the greater ease with which it may be cleansed. The rim is a tin plate, which has two openings; one eight inches and a half long by four inches in width, through which the cream is poured into the churn, and the hand is introduced for the purpose of cleansing it; the other, a short pipe one inch in diameter, through which the butter-milk runs out of the churn, when the process of churning is finished. The first of these openings is furnished with a wooden cover, fastened down by means of two screws; and to the other a cork is fitted, while the butter is churning. Near the larger opening, there is also a small vent-hole, with a peg to admit the passage of any air that may be involved from the cream at the beginning of the operation. Farther, an axle passes through the churn terminating in two gudgeons, on which it hangs; its lower part being plunged in a trough, for the purpose of holding, occasionally, cold or hot water, according to the season of the year. On the inside of the rim are four projecting pieces of wood, with holes, with which the cream is agitated by the motion of the churn. This motion is caused by a pendulum, three feet six inches in length, that has an iron *bob* of ten pounds weight, and at its upper end a turning pulley, ten inches in diameter, from which a rope goes twice round another pulley, about three inches in diameter, that is fixed on the axis of the churn, which it causes partially to revolve by each vibration of the pendulum.

Besides, the machinery is provided with sliding covers, and

* Other improved churns are delineated and described in the 26th and 30th volumes of the Society's Transactions; to which want of room compels us to refer the reader.

the water-trough has another, for the purpose of securing the steam, when hot water is used; and for keeping the cream in a proper degree of warmth. The motion of the pendulum is given and kept up by means of a wooden rod, about three feet nine inches long, which turns on a pin about three inches above the bob of the pendulum. An accurate view of the mechanism above noticed will, it is hoped, be found in the annexed figure of Mr. Bowler's improved churn.



The letters A A designate the body of the churn, which may be made of tin, for the reason already assigned.

B, the opening through which the cream is poured in.

C, the cover of the large opening: the small aperture on the opposite side cannot be represented in the cut.

D, the axis, or gudgeon, on which the body of the churn is suspended.

E, the upper or larger pulley.

F, the smaller pulley, which is fixed on the axis of the churn.

G, the rod of the pendulum, hanging from the upper pulley E.

H, the *bob* of the pendulum.

I, the handle, moveable on the pin at *a*, by which the pendulum is moved, making a traverse in the form of the dotted line K K.

L, the trough for receiving hot or cold water, according to the season, and which may be preferably made of tin, because that metal is a better conductor of heat than wood.

M, a projecting piece of wood, with a shoulder, that supports the handle I, when the churn is not at work.

CHAP. VI.

Different sorts of Soils.—Various modes of improving and of converting them from a state of nature.—Manures.—Fences.—Formation and management of Meadows.—Irrigation.

SECTION I.

DIFFERENT SORTS OF SOILS.

Analysis of Soils.

SOILS have been divided into various classes, according to the nature, quality, and proportions of the various particles of which they consist, and which necessarily influence their fertility. The constituent parts of soils are carbon, lime, clay, and siliceous sand; by analysing which, several eminent chemists of this and of other countries conceive, according to the respective portions of these ingredients, that the relative

fertility of soils may be ascertained. As, however, few practical agriculturists, comparatively, can spare the time and expense which the chemical analysis of soils requires;* it has therefore been suggested, that the relative fertility of soils may be examined by calculating their specific gravity, when dried at equal distances from the fire, in bladders perforated with small holes; and, after they have been immersed in water, by accurately observing the difference between their respective weight, both in water and in the air. A similar mode of determining this question was suggested by the late Dr. Darwin, who proposed to dry a few pounds of different soils in the same temperature; after the evaporation of the moisture, they are to be weighed, and exposed to a red heat. And, as carbon is the chief constituent of calcareous earths, he conjectured those soils, which lost the greatest portion of their weight, to be the most fertile, as the carbonic matter (which affords the principal nutriment of vegetables) will be dissipated in the flame.

A more certain criterion, however, by which the relative fertility of land may be ascertained, may be obtained by persons of sound judgment and experience, by simply attending to the growth and colour of the different vegetables that are spontaneously produced. Thus the rush, flourishing in cold and wet clay soils, may generally be considered as indicative of such soils; brook-lime, and some species of cresses, abounding in moist grounds; the common nettle in dry, loamy soils; the fox-glove and sand-wort in sandy situations; the way-thistle, or corn saw-wort (*Serratula arvensis*, L.) in good soils; the common dock in inferior grounds; all characterise the different varieties and descriptions of soil. But, after all, the best guide in ascertaining this point will be *experience*, the result of long and frequent attention to numerous local circumstances; as the remarks hitherto made by naturalists are neither sufficiently full nor extensive to afford any *standing* rules.

* But such agriculturists, as can afford both time and expense for this purpose, may employ them beneficially by applying the principles of analysis, laid down by Sir Humphrey Davy, and illustrated with great clearness, in his *Lectures on Agricultural Chemistry*, pp. 158, &c. 8vo. edition. Much valuable matter relative to the Chemical Principles of Soils, is also contained in Mr. Naismith's "Elements of Agriculture," 8vo.

Soils may be divided into the following classes :

- | | |
|---------------------|-----------|
| 1. Vegetable mould, | 4. Sand, |
| 2. Clay, | 5. Chalk, |
| 3. Loam, | 6. Peat, |

each of which comprises several varieties that will be noticed according to the proportions of the various ingredients of which they are composed.

1. *Vegetable Mould*, sometimes called the *staple*, is almost every where spread to a greater or less depth on the surface of the earth: it is formed by the dissolution of vegetables, and may be augmented by the application of manures, vegetable, fossil, and compound. Every kind of mould does not possess the same degree of fertility; thus, that which lies in shady situations is generally richer than what is exposed to the sun. Its fertility is also affected by the nature of the acid which accidentally adheres to some sorts of mould, and which is either, 1. *vegetable*, arising from stagnant water, or more correctly, from *stagnating water*, which is dissipated by exposing the mould to the solar heat; or, 2. *mineral*, which is not dissipated by drying in the sun, and arises from water brought to it, that is charged with such mineral acid. The *former* is of material use in impregnating soils, provided its rich particles be not washed away; which is necessarily the case, when the turf is alternately overflowed and dried. The *latter* must be divested of its acid, before it can be used with advantage. In dry years, mould becomes too loose, so that all its moisture escapes by evaporation, and thus it easily loses all its richer particles. Further: in this loose state it cannot be easily frozen into one mass, but rather into small pieces; hence the roots of plants are easily torn asunder, and the cold is admitted to them, and they are consequently destroyed. Under such circumstances, it will be necessary to resort to the use of perfectly-extinguished lime, in combination with various saline matters, in order to render the vegetable mould productive, and to reduce it to a proper state.

2. *Clay*.—Under this denomination are included the various sorts of land usually denominated lime-stone clay, strong land, stiff land, strong loam, stiff loam, and *marmy clay*, all of which

differ greatly in their qualities and properties, and also in their greater or less tenacity and colours. Clayey lands are naturally steril, from their adhering together in masses; unless indeed a summer be so divided between rain and sun-shine, that they are kept in a medium continually between drought and wetness; a circumstance that rarely happens in this variable climate. In wet seasons, plants growing on such soils are inundated; the closeness of the clay will not let the water soak into the ground; and, in a dry season, the ground becomes so solid, that the roots of plants cannot penetrate. A tolerably accurate idea of the fertility or barrenness of clay soils may be obtained, by regarding the appearance of the different plants as they vegetate; if they appear lively and vigorous, a favourable opinion may be drawn; the reverse of course follows, if they appear languid, unhealthy, and stunted in their growth.

Clay is thought to contain more of the food of plants than almost any other soil; without much alteration, such lands will produce good crops of grass, provided care be taken not to feed them too closely, nor to admit cattle into them in the spring. In order, however, to bring them into tillage, it is necessary that clay soils be altered by the admixture of such substances as tend to open the soil, and to break the cohesion of its particles. When once this object is accomplished, the land will become highly valuable, retaining manure excellently well, and never returning to its former state.

Clay lands are capable of great improvement, by the judicious application of *manures*, and a regular course of *tillage*. With regard to the *former*, lime-stone, gravel, and marl, are the most useful articles; the best season for laying on which is in the month of January, as it is only during winter, while the surface is frozen, that teams can stir. Where those fossils cannot be procured, a mixture of dung and sand (beach sand is preferable to that obtained from pits) will contribute to fertilize the ground. The application of lime alone has, in many instances, been attended with great advantage; though some eminent agriculturists disapprove of it, on account of its being apt to cake, and not mixing intimately with the soil. A variety of substances may likewise be employed in case of a deficiency of those fossils; such are composts of chalk and dung, tanners' bark, and other manures, that promote a strong fermentation. And it has been found by experience, that chalk and these

together not only enrich the soils, but also make it produce earlier crops than it did before. The chalk, indeed, thus laid upon the land, at length subsides, settles as deep as the plough goes, and is then of no farther value in opening the land; but it may be recovered, and brought up again to the surface, by ploughing somewhat deeper than ordinary; after which it will produce its former good effects. Gravel, from neighbouring soils, may also be carted upon clay lands; to which may be added sea or pit-coal ashes, dust from saw-pits, chips, and rubbish from the back yards of houses, straw and stubble, rotten wood, burnt clay, peat ashes, and perhaps *gypsum*, or plaster of Paris.

With regard to the *second* point essential to the improvement of clay lands, viz. *tillage*; after such soils have been sanded, or any other manure calculated to open it has been carted thereon, it will require several ploughings and harrowings to mix it, so as to bring the land to a good consistence. The depth of ploughing on such lands varies according to circumstances, and their respective peculiar situations. Further, as clay soils retain moisture longer than any others, they ought to be kept as dry as possible; as the stagnation of water not only renders them acid, but also materially injures the crops. Lastly, suitable seasons should be embraced for ploughing clay soils, when they are neither too wet nor too dry; as, in the former case, it will become poached with the feet of the cattle; and, on the other hand, when it is very dry, it cannot be well turned on account of its tenacity and stiffness. At the first ploughing the clay comes up in large clods, but the oftener it is stirred with the plough, at proper times, the more is the cohesion of the particles broken, and the more easily can the roots of plants penetrate deeply in search of their food.

3. *Loam*.—This species of earth is more compact than chalk, and less cohesive than clay. It is divided into several varieties, according to the substances or ingredients of which they are composed; the constituent parts of which are clay and coarse sand. *Clayey, strong, stiff*, and as it is sometimes called, heavy *loam*, consists of a mixture of coarse sand and clay. The sandy loam contains similar ingredients with the preceding variety, although the sand prevails in a larger proportion.

Loamy soils being, in general, less tenacious and more friable than clays, are capable of being more easily improved with less

expense and labour of team, and also at any season of the year. The manure proper for such soils varies according to their relative degree of fertility, and the greater or less proportion of acidity, and of argillaceous and calcareous matter they contain. Those loams which are contiguous to the banks of rivers or the sea-coasts, are generally admitted to be so fertile as to require little additional aid from manure; but for the more heavy and adhesive kinds, a compost of lime and dung, or lime in combination with pulverized or ground bones and blood, or other animal recrement, and such terrene substances as contain large quantities of sand, may be beneficially applied in such quantities as the tenacity, or poverty, of the land may require. Where the argillaceous principle abounds, lime alone may be spread on the soil, in order to counteract the acidity prevalent in such soils; in the contrary case, or where there is an abundance of sandy, gravelly, or chalky particles duly mixed with the loams, well-rotted dung, vegetable manures (see these specified *infra*, Section III.), and the mud or deposition procured from stagnant waters, may be spread to the greatest advantage; and, in case the loam be too friable, or light, a quantity of clayey loam may be carted on the land, sufficient to impart a proper degree of cohesion.

4. *Gravelly and sandy Soils.*—*Gravelly soils* are composed of gravel, of various degrees of fineness, which is either siliceous or flinty, or calcareous or chalky. Such soils are very porous; and, though they receive moisture with facility, yet, as they part with it with equal readiness, they are apt to burn during the intense heats of summer, unless this effect be prevented, or removed, by the use of marl, or other fossil manure. For calcareous, gravelly soils, clayey loam is the best remedy; or chalk and clay, or extinguished lime and clay, may be applied with advantage. Besides which, there are various composts of animal and vegetable recrement that may be employed with the same intention; such as well-rotted farm-yard manure, combined with ashes, mud, loamy mould, &c.

Sandy soils are composed of calcareous, siliceous, or stony substances, of various colours, according to the different matters with which they are mixed; black, white, red, or yellow. From their tenuity, sandy soils cannot be cultivated with advantage, without the aid of other fossil manures to counteract their poverty, and prevent the continual evaporation of moisture

For this purpose clay and loam may be beneficially spread on sandy soils, which may likewise be improved by the use of composts of animal and vegetable manure; though, where these cannot be obtained, good mould or earth may be employed with advantage; as also may peaty earth, either alone, or in combination with other matters. A degree of tenacity, or firmness, may also be imparted to sandy soils by the treading of sheep, folded upon them, while they receive much benefit from the dung and urine deposited by those animals.

5. *Chalky Soils* occur in various parts of Britain, in large tracts, and of various descriptions, according to the nature and quantities of calcareous matter which they contain, the depth and qualities of the layer of earth which lies upon it, and the substances that are confined with it, as well as the substratum, or sub-soil, in which the earth is deposited.

The utility of chalk and lime, as a corrective of other soils, has already been intimated; from the burning property of these fossils, however, they require to be mixed with other matters, to render them more fit for the purposes of vegetation. Thus, in the thinner or lighter calcareous soils, clay or clayey marl, and the vegetable recrement obtained in wet or swampy situations may be beneficially applied. In soils of a contrary or heavier nature, the spreading of sandy and clayey loams, as circumstances may require, will be attended with advantage. To these may be added composts of various vegetable and animal substances, farm-yard manure, and ashes; beside which, great attention is requisite in breaking up these soils at the proper season; as, if this operation be deferred till a dry season, they become so *bound*, or hard, that it will be impossible to work them, until they are softened by rain, without very great expense both of teams and of labour.

6. *Peat*.—Under this denomination are included those soils, which in England are called moory, peaty, and boggy, or fenny soils; and in Scotland they are termed *mosses*. Various theories have been formed to account for the formation of peaty soils; but, from every inquiry that can be made on this head, they appear evidently to have originated from the roots of trees and other decayed vegetable matter, supplied by the dissolution of plants flourishing in humid

situations, as also by other substances brought down from surrounding high grounds, and there gradually deposited.*

According to the nature of the vegetables forming these soils, the peaty matter is found in different places of different depths and degrees of closeness, as well as of colour; this depth varies from twenty to fifty, and sometimes more, feet, and the colour is chiefly red or black, intermixed with various shades. Peaty soils are extremely porous, and consequently very retentive of water; and where they are very deep, they are rarely free from the excessive humidity with which they are loaded in consequence of long-continued rains.

As peaty soils thus necessarily vary according to the substances that enter into their composition, various methods of treatment become requisite, in order to prepare them for the different purposes of husbandry.

In deep, boggy, or mossy soils, *draining* (where it is practicable) ought to be resorted to in the first instance, in order to draw off the excessive moisture. Various hard, dry earths will also be found of great use in improving bogs, such as gravel, chalk, stones, sand, shell-marl, &c. as these substances contribute to bind, ameliorate, and warm the soil, while they prevent springs from oozing up and overflowing the surface. Should they be over-run with heath, rushes, and similar coarse vegetables, quick-lime may be beneficially applied; paring and burning, (provincially termed *denshiring* and *burn-baiting*), may likewise be resorted to with advantage. Another useful mode of reclaiming such soil is, by planting thereon those vegetables whose spreading roots serve to bind the earth together, and at the same time, in a great measure, exclude the action of the atmosphere upon it.

Lastly, irrigation, or flooding of mosses, where a command of limpid current water can be obtained, is perhaps the cheapest and most efficacious way of reclaiming them; cases at least have occurred where such soils have been brought into a state of cultivation, for *meadows*, with the happiest success, which had failed under contrary methods of management. The manner in which such flooding is to be effected will be specified in a subsequent section of this chapter.

The following system of converting peaty soils into a pro-

* See further on this subject, Sir H. Davy's *Lectures on Agriculture*, pp. 190—192.

ductive state, is recommended by Sir John Sinclair; and, although it involves a few details which properly belong to the subsequent part of our work, yet, as they will not admit of being conveniently detached, we prefer to exhibit them in one connected form, in this place.

He directs the land first to be drained, in order to prepare it for ploughing, and the *heather* (heath) to be burnt: the surface is then to be ploughed with the fen plough. What is pared off, may either be made into turf-walls for sheltering the ground, or employed to fill up the hollows, or burnt; though, he remarks, the ashes of the surface are in general so light, as to be of little service as a manure. The surface being cleared, the peat or moss is to be ploughed with a common Scotch plough, during the months of September and October, and all the winter months while it is practicable, from six to nine inches deep, exposing it as much as possible to the frost. The frequent use of the roller (and the heavier the better) is of the greatest importance, rendering it capable of producing abundant crops of grain or grass much sooner than could otherwise be expected; while it effectually banishes that noxious weed *sorrel*, with which it would otherwise be overspread.

In the following spring, the land thus prepared will be fertilized by the frost, and by harrowing will be easily converted into mould. Any clods that may be found in a rough state must be burnt: and, if the season be dry, some of the surface may be burnt, the ashes be immediately harrowed in, and the ground sown. Dung, lime, clay, sand, or small gravel, may also be employed as manure, if circumstances will admit of it.

On lands thus prepared, *bere*, or *bigg*, seems to thrive: oats, also, Sir John Sinclair states, would answer well; and rye would probably succeed. Rape would certainly be productive; and, though red clover has not yet answered, he is of opinion that it will probably succeed, when the lands have been longer under cultivation. Rye-grass and *Yorkshire fog* (the meadow soft grass) seem to answer particularly well; although it has not yet been ascertained by experience what is the best succession of crops for these lands, the great object is to get them laid down to grass as quickly as possible. They can then be broken up with the fen-plough, the surface burnt, and the quantity of rich ashes which the roots of the grass will produce, will ensure a succession of abundant crops for at least three

years; two of which may be grain, and with the last crop of grain the land may be again laid down to grass.

By following the above system, Sir John Sinclair states, there is every reason to believe that the extensive bogs in England, Scotland, and Ireland, may be rendered fertile, and a great addition made to the wealth of the country and the subsistence of its inhabitants.*

SECTION II.

DIFFERENT MODES OF IMPROVING LAND.

1. DRAINING.

Few operations are more important in the improvement of land than that of draining; for, though vegetation cannot proceed without an ample supply of water, yet there are cases where there is such a superabundance of that element, as to be productive of the most injurious consequences to the health of plants, and especially to persons who reside in the vicinity of such swampy situations.

It is, therefore, of the utmost importance to the farmer, that he duly consider the cause of the excess of moisture, which is thus prejudicial to his interests, and to rectify it accordingly. Various methods of draining have been suggested by ingenious men, which are applicable to various soils. If the land be not marked by any strong inequalities of surface, and the wetness proceed from the texture of the soil, particularly the substratum; the system of hollow draining, applied to the whole surface, is, in Mr. Young's opinion, the best cure the evil will admit. On the contrary, where the land is situated on a declivity, springs break out on the slope, which greatly damage the land below; in this case, a different system of management must be adopted, as the common methods of draining are rarely adequate. In discussing this important branch of rural economy, therefore, we shall first state the various methods of

* Sir J. Sinclair on Scottish Husbandry, Vol. ii. (Appendix) pp. 162, 163.

draining, applicable to lands of the first description, and then proceed to notice that system, or plan, which is best calculated for those last noticed, viz. uplands.

1. With regard to lands which are not marked by any striking inequalities of surface, in the counties of Essex and Herts, (which contain many districts of this nature), the method of cure resorted to is *hollow-draining*, or land-ditching, as it is sometimes termed. It consists in digging main and side drains, like those commonly made in draining land; the depth of the main drain varies from twenty-two to twenty-four inches. That of the side drains from twenty to twenty-two inches. The soil is first ploughed; and the length to which the main drains may be continued without a vent, depends on the situation of the land. If it has a gentle slope, it will be proper to carry off as much water as possible by means of side drains; sometimes, however, the surface of the ground is unequal, in which case it becomes necessary to form additional main drains.

The length of the side drains depends on the greater or less elevation of the soil: in general, one rod is a sufficient interval between each; but in very porous or loose grounds, they may be made one rod and a half asunder. The trenches being cut of a sufficient depth, they may be filled up with stones (if these can be procured), or with brush-wood, bones, straw, fern, heath, &c. and the surface earth laid on *archways*. In making drains of this kind, the chief object, in the opinion of the most experienced drainers, is not durability of the materials, but the proper *arching* of the earth, which will remain perfect when the other materials are decayed. In several parts of Essex there are drains thus made, which run very well, although they were filled only with straw upwards of forty years since. The expense is stated to be about 3*l.* per acre. As those hollow drains continue longest serviceable which have a good fall, it will be advisable in all cases not to be sparing in giving a fall whenever circumstances will admit of it. But as straw will eventually rot, and in that case becomes a receptacle for breeding worms, which incites moles to work much where it is, Mr. Naismith recommends boughs of pine to be laid in the conduits or drains, in order to prevent them from being choked; as moles are said to shun substances containing resin.*

* "Elements of Agriculture," p. 311.

Sod or earth drains are usually dug to the depth of two feet with a spade, after which the earth is removed by means of a scoop, about four inches in width; and the drain is covered with the soil first taken out, if the ground be sufficiently firm to sustain their weight; if not, some black-thorn bushes are put in for that purpose.

Another method of making common earth-drains consists in digging two or three spits deep with a broad spade, and excavating the bottom with a narrow one, after which the drain is filled with stones.

Or, a furrow may be drawn with a plough, and cleared with a common spade; the draining implement, delineated in the annexed fig. 1, is then to be introduced to the depth of one



foot and a half from the surface; and the loose mould to be removed by the scoop, represented in fig. 2: along the bottom should be laid heath, or black-thorn bushes, covered with strong wheat straw, closely twisted to the thickness of a man's leg; after which the whole is to be carefully closed in.

In all cases, the apertures or mouths of drains ought to be effectually guarded by a railing, or grating, to prevent the water-course from being obstructed by the treading of cattle attempting to drink at it. And the passage for the water at the bottom should uniformly be narrow, as the force of the water will be fully adequate to remove any accidental impediments to its course, and consequently such drains will be more durable.

Where the common methods of draining cannot be adopted, *stone drains* may be resorted to with advantage. They should be cut ten or twelve inches wide, with perpendicular sides; and flat stones be so disposed as to leave a water-course at the bottom, by setting two stones in such a manner, as to meet triangularly at the points. Or flat stones may be placed along the bottom, and three others placed upright, and the water left

to work itself a passage between them. At all events, the cavity of the drain should be filled nearly up to the top with loose stones, for which screened gravel may be advantageously substituted, where a sufficient quantity can be commanded. The principal drains ought to be three feet in depth, by one foot and a half in width; the top and bottom laid with flag stones; the sides raised, or built up to a sufficient height with common stones; the whole being covered with sods of turf, with the sward or grassy side downwards, and over these is to be spread sufficient earth to admit the plough. In general, the smaller drains are to be conducted into the main trenches at an acute angle.

Within a few years, a peculiar mode of draining land with chalk, as a substitute for stones, has been successfully practised in the county of York. The trenches are cut in the common manner, and then filled with pieces of chalk; on these is laid a thick bed, or layer, of evergreen boughs, which again are covered with the sod or earth. The extremities of the main drains are arched to a short distance with brick-work, to preserve the chalk from the effects of frost, which will otherwise reduce it to powder, and, of course, injure the drain. By using chalk in this way, the growth of moss is effectually prevented, and a free current obtained for carrying off the water.

In the preceding methods of draining, and indeed in every other mode that may be adopted, it ought to be constantly understood that, where there is a declivity in the field, the drains should have a very gentle descent, lest the water, by a quick current, should hollow the earth, and make itself new channels. On the contrary, the moister and flatter a wet field is, the more in number, as well as larger, should the drains be made: in fact, they should, in every case, be proportioned to the quantity of water to be discharged, the smaller opening into the larger. And particular care ought to be taken that the drains be of an equal depth, in order that water may in no place stagnate and putrefy, and that in arable lands furrows be made to carry the water every where into the ditches: precautions these, which become peculiarly necessary where large quantities of snow are dissolved in the spring, or the place is subject to inundation.

Farther, with regard to the draining of bogs or marshes, where a sufficient fall can be procured, the first object is to

ascertain the lowest spot of dry ground that surrounds it, in order to open on that part of the main trench which is to carry off the water; and if there be any trace of a current, or stream, this should be followed with the greatest care, as it may serve to point out the precise spot on which to begin. The main trench, beginning at the lowest part, may be carried on to any distance required; if it commence at the proper spot, ten acres may be detached from the marsh, whatever its extent may be, and perfectly drained. The main cut, or trench, ought to be ten feet broad in the clear, with a proper slope, in order to prevent the sides from falling in and filling it up.

It has been intimated, in a preceding section, that bogs are divided into two parts, black and red, according to the substances that enter into their composition. The red sort is altogether unfit for the purposes of fuel; but the black sort is solid, and affords excellent fuel for domestic purposes. In digging bogs of the last-mentioned description, therefore, the soil taken out of the drains ought to be cut into turfs, and dried for use.

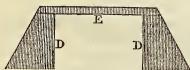
In proportion as the main canal advances, small ones may be cut into it on either side; the depth of the former must be regulated by circumstances; but the cross cuts should be at least four feet broad at the top, by three feet in depth. A whole year will be required to finish these drains; and in the succeeding spring it will be necessary to open and deepen them, and clear them from any matters that may have casually fallen in;—this work indeed should be occasionally renewed. During the second year, the main trench should be extended; fresh inclosures may also be then formed by making fresh lateral cuts, and these may be drained by means of small cross drains. The advantage resulting from this mode of draining, though it be necessarily laborious and expensive, is very considerable; for, by the operation being thus gradually completed, the labour in succeeding years will be greatly reduced, in proportion as the bog subsides.

Where no fall can be procured, the water may, in many situations, be collected by cutting a long, horizontal ditch above the level of the marsh, so as to intercept all the wall springs; after which the water may be carried off in wooden troughs, or hollow bricks, above the surface; and in case water should continue to penetrate the morass, it may be conducted

to the extremity of the ground, either in open drains, or in covered brick drains, represented in the annexed figure,



which describes a hollow brick, two of which (one being placed upon the other) form a pipe, or tube, which is chiefly useful in making small drains.



DD are two bricks placed opposite each other, and then covered with a stone on the top, marked E, in which situation they will form a large drain; such bricks being kept firm and steady by the mould pressing on their sides. The turf taken off the soil should be laid upon the stone, with the sward or grassy side downward.

In a former section we have noticed the various implements that are employed for the purpose of draining land. In draining low lands, however, these ploughs may be advantageously superseded, in some cases, by the use of a cast-iron *roller*, or *wheel*. It weighs about four hundred weight, and is four feet in diameter. The cutting edge, or extreme circumference of the wheel is half an inch thick; it increases in thickness towards the nave, or centre, and will cut a drain half an inch wide at the bottom, increasing gradually to the width of four inches at the top, and about fifteen inches deep. This wheel may be so placed in a frame, that it may be loaded at pleasure, in order to penetrate to a greater or less depth, according to the resistance of the ground; which being thus cut in the winter, the tracks of the wheel may then be filled with twisted straw, and lightly covered over, or left to crack wider and deeper in the course of the following summer; when such clefts, or cracks, ought to be kept open with twisted straw, and covered over as above mentioned with light, porous earth. Hollow drains of this description are peculiarly calculated for grass lands, at a comparatively small expense, and will answer every useful purpose.

Sheep pastures may be drained of the superfluous surface-water, by means of a strong common plough, in the following simple manner:—After turning up furrows through the hollow parts of the field, where the water is apt to stagnate, let a man pare off the loose soil with a spade, leaving the inverted soil, or grassy sod, about three inches thick; after which let him turn the sod over into the furrow, with the sward or grass side uppermost. Thus a canal of three or four inches will be left at the bottom of the furrow, sufficient to discharge a considerable quantity of water, which will readily subside into it.

It sometimes happens, however, that clayey soils are so loaded with water, that various drain-ploughs prove of little service, from the injury sustained by the soil from *poaching* by the feet of cattle. To supply this deficiency, and remove this inconvenience, it has been suggested by Mr. J. Middleton, to add a piece of wood to the felly of a common six-inch cart-wheel, to which is prefixed a triangular rim of iron,* the cost of which simple addition will not exceed one guinea. A wheel of the description just mentioned, when put on the axle of a cart in the usual way, will consequently rest on the triangular iron rim; and on driving the horses forward, will, by its revolution, make a small indention in the soil. In order to press it down to the depth of six or eight inches, the side of the cart next such wheel ought to be laden with iron, stones, or other heavy substances, until the rim and additional piece of wood (and likewise the felly, if necessary), sink into the soil. The cart ought now to be drawn in such a direction that the cutting wheel may revolve where it is intended to form the drains. Mr. M. states that it will sometimes be requisite to draw such wheel through every furrow; though, in the case of level land, it should be drawn over the latter in parallel lines, five or ten yards distant from each other. Of course, the wheel on the opposite side of the axle, which likewise is a common six-inch wheel, will support only the empty side of the cart, and will not cut the ground.

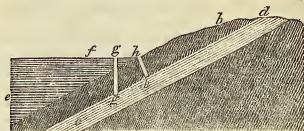
In the draining of uplands, or those lands which are situated so high that the water can flow off from them, if it be properly collected and conducted, a different system prevails; of which, though our limits forbid us to specify every various situation

* Middleton in "Commercial and Agricultural Mag." No. 22.

possible, it is attempted to convey some idea in the following outline.

In lands of this description it generally happens that the waters from the springs beneath the soil are impeded in their current towards the rivers in their vicinity. The springs in question have been found to originate from the moisture of the surrounding atmosphere; which, being condensed into water on the summit of eminences, in consequence of the increased degree of cold prevailing in such situations, penetrates the various strata of the incumbent porous soil. The water thus formed, continues to descend, sometimes for several successive miles, though in general from the nearest hills, into the adjacent valley, till, its course being intercepted by a bed of clay, it accumulates in considerable quantities; being thus forced to work its way through the porous strata of gravel, stones, rock, or sand, &c. incumbent on the clay, it follows their course or *dip* till they approach the surface of the earth, or are impeded by any obstacle, which causes the water to rise upwards to the surface, and thus produces fens, bogs, springs, &c.

At the foot of eminences then, where too great a degree of moisture prevails, the ground should be perforated with an auger, in order to ascertain the depth of the latent springs, and of course the thickness of the upper bed or layer of soil. Should this not exceed four or six feet, an horizontal ditch ought to be cut along the foot of the hill, in order to intercept the water, which should be carried off by one or more trenches communicating with such horizontal ditch, and conducting the body of water, thus formed, into the nearest rivulet. And, as the strata or layers, through which the water penetrates in forming such springs, have in general the same inclination or *dip* as the surface of the eminence, the auger-holes ought to be perforated, and the ditch cut *perpendicularly to that surface*, and not vertically downwards, as is usual in the common practice: by pursuing this mode, the arrival at the second stratum will be greatly facilitated, as the annexed figure will, we trust, render sufficiently plain.



In this figure, the letters *a b* represent the upper stratum, which may be supposed of marl; *c d* the second stratum, for instance, of sand; *e f* the earth accumulated in the valley. The letters *g g* illustrate the manner of boring the holes perpendicularly to the side of the mountain, and not perpendicularly to the horizon, as at *h h*; from which it is obvious that, in penetrating the upper stratum in order to ascertain that beneath it, the former method *g g* is much shorter, and consequently more effectual than the latter, *h h*.

Should it however happen, that on cutting a ditch five or six feet deep, along the foot of a hill, vertically to the rising plain, the upper stratum be not cut or penetrated, and of course no water ooze into the bottom of such ditch, other holes must be perforated in the bed of the latter, to the depth of some yards, or till some water appear. In case this expedient succeeds, several holes ought to be bored, and the water thence arising should be conducted into the neighbouring brook, or rivulet; as it will now rise, collect in those ditches six feet below the wet surface of the valley, and thus be completely carried off.

In proportion as the ditches above mentioned descend, they should be made narrower by means of spades calculated for this purpose; the lowest part being contracted more than any other, not only because such narrow channel gives the water a more rapid current, but also in order that its shoulders or edges may support stones, or faggots, for covering the drain at a small expense, without affecting or impeding the current of water. Hollow bricks, ridge tiles, or fragments of plastered floors, may be chiefly substituted for stones, pebbles, or faggots.

For draining a hill, composed of alternate beds of rocks and clay, it will be necessary to make different drains across, through the wet ground, and at different heights, to communi-

cate with a drain from the upper wet ground. The removal of superfluous moisture from soils that are porous above and retentive below, may be effected by making a large drain in the most convenient place, and cleaning the *furs* well, to serve instead of smaller ones.

The system of draining uplands, above detailed, is that pursued by Mr. Elkington, whom the Board of Agriculture honoured with a liberal premium for communicating his *discovery* to the public; although the priority of such discovery was claimed by the late Dr. James Anderson, who is asserted to have published an account of it ten years before. From a consideration of the various circumstances, it will be seen that draining depends upon three points.—1. Upon finding the main spring, or cause of the injury the land sustains, without which nothing effectual can be done.—2. Upon taking the level of that spring, and ascertaining its subterranean bearing; for, if a drain be cut a yard below the line of the spring, the water thence issuing cannot be reached; but by ascertaining that line by means of levelling, the spring can be cut off effectually, and consequently the land will be drained in the cheapest and most complete manner.—3. By making use of the auger, to reach or *tap* the spring, and give vent to the water thus confined, when the depth of the drain does not reach it; where the level of the outlet will not admit of its being cut to that depth, and where the expense of cutting so deep would not only be very great, but the execution of it accompanied with very considerable difficulty.

Sometimes, however, situations occur, in which the first stratum of earth is too thick to be easily pierced by the auger; or, where the water, condensed in the manner already stated, may work its passage between the second, third, or fourth strata, forming the sides of the hills from a deficiency of so many of their strata at the summits. Consequently the water, being confined by the substances which form the plain of the valley, ascends through them to the surface, and thereby forms marshes and bogs; this inconvenience may be successfully obviated, by adopting the common method of draining.

Lastly, when the drains have rendered the marshes sufficiently firm to allow cattle to walk on them, the heaviest rollers that can be obtained should be drawn repeatedly over them during the first year, in order to consolidate them effectually.

Previously to rolling in the spring, it has been recommended to sow every kind of grass-seeds indiscriminately on the land, such as clover, hay-seed, ray-grass, or darnel, &c.

In the course of the preceding details on draining uplands, frequent mention has been made of the *auger*, an effective implement for most common purposes; but as peat, when perforated with this instrument, is apt to close, by being pressed only in a *lateral* direction, *without being cut*, the current of water is liable to be again impeded, and consequently the work is rendered ineffectual. To obviate such inconveniences, a useful implement has been communicated to the public by Thomas Eccleston, Esq.* of Scaresbrick Hall, in the county of Lancaster, of which the annexed figure will afford an idea.



A is the cutter of the *peat borer*, (for such is the name of Mr. E's contrivance), which penetrates the peat.

B, the body of the borer, which is six inches in diameter.

C represents the opening through which the peat, introduced by boring, is extracted from the ground.

D describes part of the iron bar of the peat-borer, to the upper part of which a cross handle is to be attached.

By means of this machine, a cylindrical column of peat, six inches in diameter, will be effectually cut out and removed, and thus afford a free passage to the water. Thus the trouble and expense of draining marshy land may be considerably reduced; and they will at length become so firm, that the first drains will continue uninjured. In his communication to the Society for the Encouragement of Arts, Mr. Eccleston states, that the situation of the soil must regulate the proper depth to which the peat-borer ought to descend. Where moss lands are very low, and liable to inundation, it will be proper to penetrate only sufficiently deep to drain the surface, as deep boring would cause it to sink so exceedingly low as to be overflowed by every sudden shower of rain.

* In the "Transactions of the Society for the Encouragement of Arts," &c. Vol. xix.

Before the subject of draining is dismissed, it may not be altogether unnecessary to notice a fact relative to the obstructions to which drains are liable, either from stones or earth falling into them from the sides, but more particularly from the growth of the marsh horse-tail (*Equisetum palustre*, L.); an aquatic vegetable, that has been discovered growing within drains to a very considerable extent, which it has at length completely choked up. For the following remarks on the effects produced by that plant on drains, we are indebted to a communication by Sir Joseph Banks to the Board of Agriculture.

At the Duke of Bedford's seat, at Woburn, Bedfordshire, some bogs, drained by under drains, made at a great expense, appeared at first perfectly dry, but were afterwards found to become gradually less so. On examination, these drains were found more or less choked by a plant vegetating *within them*, and forming, both stems and roots, the whole several yards in length, intercepting the course of the water, weakening the current by degrees, and at last wholly choking up or obstructing the drain. This plant is the *Equisetum palustre*, a weed common in moorish and swampy ground, though little noticed by naturalists. Its root, or rather its stem, under ground, is a yard or upwards in length, and in size like a pack-thread; from this a root of twice the size of the stem, runs horizontally in the ground, taking its origin from a lower root, which strikes perpendicularly downwards, and which Sir Joseph Banks says, he has been able to trace as thick as a small finger. This root forms, in some places, beds which occupy a large portion of the more solid spots of a peaty bog, as might be seen in some parts of the banks of the Duke's open drains. As the bud, by which the plant appears to renew itself in the spring, is situated on the horizontal root, a yard or more in depth, the shoot must, in its progress upwards, be liable to meet with under drains, and penetrate into them, through the openings left for the passage of the water. When once entered, nature has given the plant powers of piercing the soil upwards, and to enable it to vegetate in the atmosphere of a drain. The evil, if known, Sir Joseph Banks thinks, may be removed by casting the under drains into open ones.*

* "Communications to the Board of Agriculture," Vol. ii.

2. FALLOWING.

Fallowing is a mode of preparing land for the reception of grass seeds, grain, or other crops, by repeated ploughings for a considerable time before it is finally ploughed for seed. By this operation a variety of alterations is produced in the soil, which is ultimately rendered more mellow than could have been otherwise effected. The beneficial consequences resulting from fallowing are thus stated by Dr. Darwin.—*First*, By repeatedly turning soils over, much fixed air, or carbonic acid, is produced in a fluid state, which becomes and continues united with the vegetable recrements, or with volatile alkali or calcareous earth. *Secondly*, The constituent parts of the soil become better incorporated, and thus reciprocally ameliorated, so that they will afford more uniform nutriment to the roots of plants.—*Thirdly*, The pulverized soil may be more easily penetrated, and thus exposes a greater surface of its cavities to the vegetable absorbents.—*Fourthly*, all useless and noxious weeds and plants will thus be eradicated, or continually ploughed under the soil while they are young; so that a considerable quantity of vegetable nourishment will not only be reserved, but also increased, by the saccharine and mucilaginous matter of such young plants turned in by the plough.—*Lastly*, There are some plants which, during their herbaceous state, do not exhaust the land on which they grow before the seed stems arise; such, for instance, are turnips, when pulled up and carried off the land for feeding cattle elsewhere. This advantage is produced by the earth being shaded by the thick foliage of these vegetables, and of course ameliorated; because its nutritious properties cannot have suffered so much by evaporation as if the soil had been exposed to the scorching influence of the sun (“Phytologia,” p. 283, &c.)

Lands are laid fallow, either in winter or during the summer season, according to the nature of the soil, and as the judgment of the farmer shall direct. There is, indeed, a great difference of opinion among experienced agriculturists as to the propriety or inutility of winter or summer fallowing. The benefits resulting from this practice, however, are obviously such as necessarily to lead to this inference, that winter and summer fallows are *occasionally* useful in different soils; and

consequently the *nature* and *qualities* of such soils afford the best criterion for this purpose.

The late Dr. Darwin, adverting to this subject, has judiciously remarked, that, though a summer fallow may be beneficial to a poor soil which has nothing to lose, yet it must prove injurious to a rich one, which has nothing to gain. Thus, dry gravelly soils may be well managed without fallowing; because (being chiefly in culture for turnips, potatoes, and similar herbaceous plants, above referred to), they are preserved by repeated hoeing in a sufficiently mellow state, and kept thoroughly free from weeds without being liable to deterioration from too much exposure by fallowing. The same remark is likewise applicable to such dry gravelly lands, the staple of which is enriched by the frequent spreading of manure. On the contrary, stiff clayey lands are best laid fallow in the summer; for, beside the prevention of *poaching*, (which, from their tenacity and stiffness, must necessarily take place in winter by the feet of cattle employed in ploughing them up), such lands are thus effectually broken up, and the various beneficial effects resulting from fallowing are obtained in their fullest extent, particularly in what respects the more vigorous growth of the vegetable sown or planted there: and also with regard to the destruction of the rank weeds that peculiarly infest lands of this description, and which can only be removed by frequent ploughing and harrowing during the summer.* Perhaps a little time before midsummer, when weeds flourish with all the luxuriance of vegetation, would be most convenient for this purpose, if the farmer could conveniently perform the operation; as the increased flow of sap, which would necessarily ensue, would cause them to perish. We are, however, aware, that there are some weeds so little affected by the exposure consequent on fallowing, that they can only be effectually removed by *manual* labour, after the soil has been previously harrowed and rolled repeatedly. The weeds thus collected may afterwards be converted into a useful compost for *manure*, by an easy process, that will be mentioned in a subsequent page.†

* Sir Humphrey Davy confirms this remark, in his "Agricultural Chemistry," p. 353, and following.

† Section III. of this chapter, on *Manures*.

After the first fallow, if the farmer pay due attention to the proper performance of that operation, a second will be unnecessary, as experience has shown, in well-cultivated places, that lands may be kept free from weeds by cultivating those crops to which the drill husbandry is applicable, so that the land may be frequently stirred around the roots, either by hand or horse hoe.

A successful instance of summer fallowing, in clearing and reclaiming foul land, occurs in Mr. Marshall's interesting work on "The Rural Economy of the West of England," Vol. ii. In July 1791, the land, then in a state of loose broken ground, was laid up into narrow ribs by a half-ploughing, with a turn-wrest plough, with the stern set *ten inches* wide; forcing up the ridges as high and as sharp as possible, in order to destroy the root weeds by drought, and by breaking their field of pasturage; and also with a view to give the seeds of weeds an addition of air and surface to promote their vegetation. Three weeks afterwards, the first ploughed part was harrowed across the ribs with long-tined harrows; levelling the surface completely, and following them with a roller, and finer harrows hung behind it; thus grinding down every clod, and effectually destroying every seedling weed that had vegetated.

A week after, the surface being thickly set with another crop of seedling weeds, Mr. Marshall turned them under by one deep ploughing across the former ribs, and in narrow pits, but *with a broad share*, and with a stern twelve inches wide; thus moving every particle of the soil about *ten inches* deep, leaving the surface rough and cloddy. Over this rough surface was spread a moderate dressing of yard dung, which was dragged, rolled, and harrowed till it was effectually incorporated with the fresh, raw soil, brought up with a view to meliorate it, and also to *force* the seeds of weeds which had accumulated there.

After the seeds of weeds had exhausted themselves, and the crude soil had received the influence of the atmosphere, the dressing was turned in with a *mean depth*, or somewhat shallow ploughing, and the surface suffered to remain in the rough state in which the plough left it during the winter. In the following spring as soon as the clods had thrown out their seedling weeds, and the weather permitted it, the surface was pulverized, to provoke the remainder to vegetation, and afterwards, at the proper season, sown with barley and lay herbage.

The success answered the fullest expectation: the field thus managed being, in Mr. M's opinion, *five pounds* an acre better for it, reckoning on twenty years from the time of performing it.

In every case, Mr. M. observes, where circumstances will allow it, an eighteen-months' fallow should be broken up in autumn, or early in winter by a *rib-ploughing*, and be suffered to lie in an exposed state during the winter. This, besides employing the winter frosts in the great work of purification, accelerates the business of the ensuing summer, and renders the whole operation a matter of ease and conveniency, and in the end *complete*; putting the soil in its most profitable state for several years. Under proper management, and with the assistance of fallow crops, lands thus effectually reclaimed may not require a repetition of the operation for half a century afterwards.

3. PARING AND BURNING.

The *paring* of land is a practice of long standing in this island, particularly in the West of England, where it is also denominated (in conjunction with *burning*) *den-shiring*, *burn-bailing*, or *sod-burning*. It consists in cutting or paring off the turf or surface of the ground, and piling it in heaps to dry; which are afterwards kindled and burnt to ashes, that are spread over the surface and ploughed in. The best time for this purpose is, from the latter end of February, throughout March, if the north-east wind prevail, to the end of May. It is proper to employ several hands in the burning, at one time, in order that a dry season may be obtained, in case the season should in general prove wet. The ashes should be spread before the plough, and turned in immediately. By breaking up old grass, or saintfoin lays, in this manner, Mr. Young observes, they are brought into order for turnips with only one ploughing; so that not only much expense and tillage are thus saved, but also the destructive turnip-fly never attacks turnip crops on burnt lands,—a circumstance of no inconsiderable importance, especially as turnips are generally a crop that amply repays the expense of paring and burning.

This operation is performed on different soils with different implements. Thus, in *old pastures*, or *meadows*, the breast-

plough is an effective implement, its thighs being armed with wooden guards. From one inch to one inch and a half is the usual depth; though two inches in depth is preferable, in the opinion of some agriculturists, on account of the greater quantity of ashes thus produced. It should, however, be observed, that the burning will be more certain, in case of unfavourable weather, the thinner the soil is pared. The expense of paring such land (including the burning of it and spreading the ashes) fluctuates from 1*l.* 5*s.* to 2*l.* per acre. In *fenny* or *boggy* situations, for instance those in the county of Cambridge, a useful implement, denominated the *paring plough*, may be employed; it turns off a furrow from twelve to sixteen, and even eighteen inches in breadth, and not exceeding one inch in depth. By using this instrument, the cost of paring, burning, and spreading the ashes is reduced to nine or ten shillings per acre; but it is calculated only for such soils as have been in a state of cultivation: for stiff lands Mr. Young has recommended a strong plough, in use on Lord Sheffield's grounds, Sheffield Place; and which was originally brought from the county of Chester. The manner of piling the sods is likewise various in different districts; but, in general, it should be remarked, that the operation of burning will be most effectually performed by piling the parings into small cocks, or heaps, similar to those made in hay-fields, placing the grass sods downwards, for the admission of air, and leaving apertures both at the top and at the bottom of each heap; but these apertures should afterwards be closed up with fresh sods, in order that the burning may be properly completed.

There is, however, a difference of opinion on the propriety and impropriety of paring and burning land, among agriculturists. By some it is pronounced to be a wasteful, extravagant operation, which dissipates what should be retained, annihilates oils and mucilage, calcines salts, and reduces fertile organic matter into ashes of very weak efficacy; and that the vegetable particles, which are brought into play at once for the production of a single crop, might, by less desperate management, be husbanded to the support of many (Farm. Cal. p. 171.) Such is the opinion of Messrs. Claridge, Kent, and Pearce, as well as of other eminent agriculturists; but their sentiments are strongly controverted by Mr. Young, and others equally experienced in the various departments of Rural Economy. By

these advocates for paring and burning it is asserted, that the objections are not founded on sound reasoning and philosophical theory ; that the most decided practice, and most extensive experience, pronounce this system to be an admirable one ; and that the mischiefs and disadvantages, stated as thence resulting, are chiefly attributable to the *abuse* of the method, and by no means necessarily connected with it. With this last opinion we cordially coincide : for the vast crops of corn obtained from soils that have been pared and burnt, prove incontestably that the soil is not deteriorated, and that the inconveniencies above detailed, as consequent on this system, are not rationally founded or supported.

The operation of paring and burning may be advantageously performed on *heaths* and *downs* which have a thin, weak, and loamy sand, with a calcareous bottom ; of such land considerable tracts have been broken up from a state of nature, on Newmarket Heath, at an expense of 1l. 16s. per acre. Immense crops have been obtained ; but from their very bad course, Mr. Young has observed, many enemies to this course of husbandry will arise, though most unjustly. *Moory, fenny, and boggy*, or *peaty* soils derive very essential benefit from this practice, which is therefore adopted in almost every part of the kingdom. Adverting to this circumstance, in his interesting "Agricultural Survey of the county of Suffolk," Mr. Young states that, without this *capital assistant*, the Suffolk farmers could not cultivate the land, it being scarcely possible to reclaim ground of this description without the aid of fire, which most effectually destroys spontaneous growth, and only fails when the labourers do not pare to a sufficient depth. *Chalk lands* also are greatly improved by paring and burning ; so likewise are *loams*, though some agricultural friends to this system have objected to employing it on such lands.*

Lastly, *clayey soils* may be advantageously pared and burnt ; for not only does it add salts to the land, which the burning of grass roots produces, but also opens part of the stratum of clay next the soil so much, that the roots of vegetables can afterwards feed therein. One objection to this practice, however, ought not to be concealed, viz. that what is properly *soil* is thus converted into masses of infertile brick ; for the chief parts of

* Farm. Calend. p. 177, where some interesting experiments, decisively in favour of paring and burning loams, are stated.

the heaps are composed of *ashes*, properly so called, and though the remaining masses are of the description above noticed, yet these are so far from being a nuisance, that they tend to loosen and open the stubborn adhesion of stiff, tenacious clays, and thus form an excellent addition to the soil.*

Upon the whole, then, it appears that the paring and burning of land may be beneficially resorted to on moist soils, provided it be conducted with caution; the ashes be spread as speedily and uniformly as possible over the surface, and especial care be taken not to exhaust it by repeated crops of wheat, and similar exhausting crops.

4. IMPEDIMENTS TO THE PLOUGH AND SCYTHE.

In the preceding sections of this chapter, the various modes of reclaiming land from a state of nature have been specified; there are, however, various obstructions or impediments that frequently prevent the soils from receiving all the benefit of which they are capable, and which will claim the notice of the industrious farmer. These it is attempted in the present section to state, together with the most approved mode of obviating or removing them.

I. **ANT-HILLS** are very detrimental to dry pastures, not only by wasting the extent of the soil which they occupy, but also by obstructing the free use of the scythe during the season of mowing. The common mode of removing them consists in dividing them into four parts from the top, and afterwards digging sufficiently deep to take out the core below; so that when the turf is replaced, it may be somewhat lower than the level of the rest of the land. This will render the spot more moist or wet, and will prevent the ants from returning to their former haunts. In the counties of Herts and Somerset, there is a peculiar sort of spade appropriated to this purpose; the blade of which is extremely sharp, and is so contrived that its whole edge describes three fourths of a circle. Several ploughs have likewise been invented, in different districts, for cutting off ant-hills level with the surface of the field: these implements, where they can be commanded, are of great utility, as they will perform the work of many men. But whatever

* Farmer's Calendar, p. 176.

method may be adopted for removing such obstructions, the work ought to be performed in November, during some part of the winter; because, if the places or spots be then left open and exposed, the frost and succeeding rains will exterminate all ants that may be in the lower part of their habitation. A contrary practice, however, has been recommended by some farmers, viz. the destruction of ant-hills in the month of April, on account of the advantage of sowing grass-seeds immediately on the spot; for which purpose a dressing of manure in which chalk has been mixed, is recommended to be thrown over it, as tending greatly to accelerate the growth of the grass-seeds. The hillocks which are cut off are directed to be carried away, and, after being thrown into a heap, mixed for some time with chalk or lime. If well turned three or four times during the summer and autumn, it will make an excellent manure for young grass, to be laid on before Christmas, as well as a good top-dressing for turnips.

II. STONES are either so firmly fixed in the soil that they cannot be removed without considerable difficulty; or they are in a loose state, on the surface of the soil, after it has been turned by the plough. In the former case they are sometimes concealed below the surface of the land, and thereby greatly injure the implements; or they are partly above and partly below the surface. In this case it has been recommended to *blast*, or blow them in pieces by the aid of gunpowder, the cost of which may be greatly reduced by mixing one pound of pulverized quick-lime with the powder;* and, after the stones have been thus broken, they may be dug out and carried away.

Such stones, however, as are found in a loose state on the surface of the land, and are liable to impede the scythe, ought to be picked off, but only in a dry season, in the month of March; for, if too many stones be taken away, the land will receive very material injury, especially if it be thin or of a light staple; because they not only prevent the crop from being scorched up during summer, but also the exudations of the earth from evaporating. And in stiff, binding land, they pre-

* Vide Griffiths, in "Letters and Papers of the Bath and West of England Society," Vol. viii., where it is stated, that a mixture of lime and powder, in the proportions above noticed, produced an explosion with a force equal to three pounds of gunpowder; consequently, by the adoption of this suggestion, *one third* of the expense will be saved.

vent its running together, and hardening like mortar in a wall, and consequently promote vegetation. The injury which soils are exposed to by picking off all the stones, has been clearly ascertained by the late Mr. Macro, an experienced agriculturist of Suffolk, who, suspecting that this practice on his turnip lands had produced more harm than benefit, tried an experiment in the spring, by picking off the stones of one square rod, after the turnips had been folded off, and laying them equally over another square rod by the side of it. He then sowed them with barley, marked them out, and at harvest-time collected their produce separately, as well as that of another contiguous square rod, which had only the natural quantity of stones. The following was the result :

	qrs. pints.		or per acre		
	C.	B.	P.		
Produce of the rod that had the double quantity of stones - - - - -	6	1	8	0	2
Ditto from that whence the stones were gathered - - - - -	6	0	7	2	0
Ditto from that in its natural state -	6	0½	7	3	1

From this experiment, the result is evidently in favour of the largest quantity of stones ; and Mr. M. is of opinion, that it is an erroneous practice, after sheep have trodden out a great quantity of stones in feeding off turnips, to have them raked up clean, as he has known some farmers do ; because the rake cannot be used without taking some of the teathe, or dung, with them. On this experiment Mr. Young has observed, that its result coincides with various observations which have been made in several counties, particularly Hertfordshire, and also in France, and that the lesson it suggests deserves no slight attention.

III. WEEDS.—Under this denomination are comprehended all those coarse, rank vegetables, which flourish spontaneously to the injury of other plants, and to the consequent loss of the farmer. As they thrive without care, and even in defiance of efforts made to suppress them, it is evident that they are of a more hardy and vigorous nature than those plants which require the fostering hand of man, and will always be apt to get the superiority, and appropriate to themselves every kind of vegetable aliment. The vegetation of the latter will, therefore, be diminished in proportion to the prevalence of the former :

hence it is of the utmost importance to prevent, as far as possible, the production of every kind of vegetable, except those which are designed to be cultivated. Weeds are either *annual*, *biennial*, or *perennial*: the two first die the *first* or *second* year (whence their name is derived), as soon as their seeds are perfected; and they are propagated only by their seeds shed on the ground. *Perennial* weeds are such as continue several years, being not only renewed and multiplied by their seeds, but also by their vivacious roots, which lie in the ground during the winter, and put forth new shoots in the spring.

The seeds of some weeds germinate as soon as they get moisture, and put down their roots into the earth, though they are not in immediate contact with it; others do not succeed unless they adhere to some mellow soil, and enjoy the reviving influence of the atmosphere. But many of these seeds, even those of the most diminutive size, will remain dormant for a very long series of years, and vegetate afterwards, as soon as any accident has placed them in a favourable situation.

Many seeds are accommodated with some kind of wing or feather by which they are conveyed from the place of their birth, and disseminated over the fields. Thus the dock genus have little wings like a bat, by which they are sometimes carried, in a high wind, to a considerable distance; others are surrounded with a light glume or husk, like a mantle; but the buoyant feathers of the sow-thistle (*sonchus arvensis*, L.), burthistle (*carduus lanceolatus*, L.), colts-foot (*tussilago*), and other weeds of the same class, bear them to the most remote places.

The vivacious roots of weeds are, some branched, some entire, some perpendicular, some inclining, some fibrous, some tuberous, some creeping, jointed, &c. All of them have the power of putting forth new plants from different parts. Some of those roots extend no further than the cultivated soil; others penetrate much deeper, and stretch their ramifications in the inferior strata to a considerable length.

From the different characters of those plants which we call weeds, it is obvious that different means of extirpating them are required. Annual and biennial plants are destroyed by pulling them up by the roots, or by cutting the stem under the lowest or first formed leaves; and after they have begun to flower, by cutting them over any where below the lowest branches. But those plants having been propagated by former

ones of the same species shedding their seeds, and many of those seeds still lying dormant, the soil is not freed of the incumbrance by destroying the plants of one year.

Vivacious roots cannot be destroyed except by turning them fully out of the ground, and either carrying them off, or exposing them to the air, till they be dried and incapable of vegetating. But many vivacious roots descend so deep, and stretch so far that they cannot be fully eradicated: such can only be checked and discouraged. As roots are fed and supported by leaves, those roots are discouraged by repeatedly depriving them of their leaves and stems.* The cutting them half through the stems, about the middle of June, or when the weeds are in full vigour, and before they generally shed their seed, will tend greatly to diminish their future growth; for the sudden interruption in the circulation of the sap causes the latter to stagnate in the roots, and consequently the weeds perish. They may then be collected and burnt, and spread on the land by way of manure; or, perhaps more profitably, be converted into a compost by the process mentioned in the third Section of this Chapter, which is appropriated to the consideration of manures.

Annual Weeds may be extirpated by ploughing them up before their seeds are formed, or at all events before they are ripe; and, where the soil has been under tolerable management, the drill-culture will be found highly advantageous. In Scotland it has been applied with the greatest benefit to turnip, potato, and bean crops, which it materially tends to keep clean from weeds; but it should be extended to every species of crop sown in spring: for spring-culture is favourable to the growth of annuals, more especially when the land is manured for a crop of grain; or when the preceding crops have consisted of turnips fed by sheep, and the ground is afterwards ploughed so deep as to raise the seeds of annual weeds, which had not been exposed to the turnip-culture, and the hoeings which accompany it.† In such cases the drill-culture may be introduced with much propriety; and will, for the most part, answer all the purposes of a clean fallow: for, by repeatedly turning the intervals, most of the annual weeds may be attacked in the

* Naismith's Elements of Agriculture, pp. 402—403.

† Sir J. Sinclair on Scottish Husbandry, Vol. i. p. 357.

groupe, and expeditiously destroyed as often as they spring; and the roots of the perennial, turned up and exposed to the drought, if not altogether extirpated, would have their progress prevented, and their numbers and vigour diminished. But the rows should also be hand-weeded, and the hand-hoe will often be found an important instrument. Drill culture may thus be partially exercised every where with great advantage, adapting the application to any particular situation or circumstances. For example, where alternate courses of tillage and grass crops are adopted, in a course of three years tillage, the second might always be in a drill; or if there were manure to spare to keep a field in good condition in tillage crops, for four years, both second and third might be in drill. The first, on account of the tough turf, and the last for the sake of sowing grass seeds, would be more conveniently in broad-cast. But the weeding of these should not be neglected. The larger weeds especially, and all those which are most prevalent, and most productive of seed, should be taken out by hand labour when they begin to flower. By such strict attention to weeding tillage crops, and stocking the ground with proper perennial grasses when laid to rest, weeds would at length be so much subdued as to be seldom injurious.*

The preceding remarks apply chiefly to annual weeds: with regard to perennials, a summer fallow is the only remedy. By turning over the ground while in a dry state, without making the surface suddenly fine, drought is admitted, so that the perennial or root-weeds do not readily grow again, whence they become weak and sickly. But though they *appear* to be dry and shrivelled, knot-grass, docks, and other perennial weeds, revive upon the return of moisture, even after they have appeared to be dead. The most effectual method, therefore, of eradicating these pernicious vegetables, is to gather them carefully by the hand: such roots, after being deposited in a large heap, and becoming corrupted, make an excellent compost when mixed up with hot lime.†

It is not, however, sufficient to attend to weeding during the time of culture only: grass-fields ought also to be kept free from all noxious and unprofitable herbage. It sometimes

* Naismith's Elements of Agriculture, p. 405.

† Sinclair Vol. i. p. 358.

happens that pastures are so over-run with large weeds as scarcely to afford a mouthful of wholesome food to the animals feeding in them;—not to mention couch-grass, or twitch (as it is also called), which can hardly be sufficiently extirpated without a fallow. There are some larger weeds with which pastures are mostly infested, and which demand a distinct consideration. These are, 1. The common dock. 2. Thistles. 3. Ragweed, or Ragwort; and 4. Coltsfoot.

1. The *Common Dock* is too well known to require any description: it is a most troublesome plant, especially in clayey soils, where it is always most frequent. Every bit of its long tap-root, if left in the ground, will form a new stem. It should be fully turned out with the dock-iron as soon as the flowering stem is formed; and as the plants of this genus rise at two seasons, the fields should be weeded twice in the summer, in order that no seeds may be allowed to ripen. The roots should be fully exposed to drought; for if they lie in a moist place, they will continue to vegetate on the surface, and strike out-side roots into the ground. Mr. Kerr, the intelligent reporter of the Berwickshire husbandry, recommends that docks be *pulled up by the hand, after heavy rains*, when the soil is soft enough to allow their long tap-roots to be easily pulled without breaking, and before their seeds approach to ripeness.

2. Of *Thistles* there are several kinds, but the most noxious are the *bur-thistle*, the *corn-thistle*, or corn saw-wort, and the *sow-thistle*. The bur-thistle, being a biennial plant, may be killed at any time by cutting it under the first leaves. But the corn and sow thistles, which are perennials, and extend their vivacious roots beyond the reach of the plough, are more difficult to eradicate. They are usually cut down by means of a well-known implement, called a Thistle-extirpator; the structure and effective utility of which, having been lately improved by Mr. Baker, of Westcoker, near Yeovil, Somerset, we have delineated it in the following figure:—



A is the handle; B the claws between which the thistle is received: the curved iron C, is the fulcrum, over which the purchase is obtained for extracting the root. D is an iron rod or bar upon which the foot is placed to thrust the claws into the ground. In case the root of the weed breaks, while endeavouring to extract it, the curved blade E, which has a sharp end like a chisel, is thrust into the ground, in order to cut off the root of the thistle some inches below the surface, and thus prevents it from vegetating. It is in the addition of this curved blade that Mr. Baker's improvement consists, for which the Society of Arts, &c. in 1810, conferred upon him their gold medal.

If thistles be cut down in rainy weather, or if much rain fall soon after, the water descending into the fresh wound of the stem (where they are cut in the ordinary way), debilitates the roots, and prevents the growth of the plants for a time. But if such critical rains do not occur, fresh leaves will immediately arise to support the roots, and the cutting will produce very little effect. They should, therefore, be annually pulled up, as soon as possible after the flower begins to form, taking advantage of the first shower that happens to fall, to soften the ground and make them draw freely. By pursuing this practice regularly for several years, the deep-lying perennial roots will become gradually weakened, and fall into decay.

3. *Ragweed*, or *Ragwort*, as it is also termed, not being deeply rooted, is best extirpated by the hand: cutting it down will be of little service, for, though some of the plants die, many survive and branch out more copiously the following

year. They may easily be pulled up when in flower, if the ground be soft at the same time.*

4. Coltsfoot (*Tussilago*), of all perennial weeds is the most vexatious to the farmer, whose utmost vigilance it will frequently elude, not only because its seeds come to maturity before the leaves expand, but also from the seeds ripening so early in the spring that they are not unusually shaken, before the grounds have got the second furrow.

"This is mocking the toils of the farmer even in the year of his fallow: for, should the whole roots of the old plants be afterwards extirpated, they have, by depositing their seeds, made sure of the succession in their own family. If, therefore, the second furrow cannot be accomplished in time, it is prudent to send hoers, two or three upon every ridge, who may carefully cut up such plants; so that they may be prevented from dropping their seeds, till they can be destroyed effectually by the plough."

Mr. Kerr, to whose valuable communication† we are indebted for these hints, recommends the months of September and October, after the grain is cut, as the best time for cutting down coltsfoot; at which season the plants are at their full growth, and easily discovered. "The method" he directs "then to be used, is, to pull up and carry off every root that can be laid hold of; and it will be observed, by inspecting the roots about an inch below the surface, that a number of buds, about the size of a pea, spring from that part of the root, which flowering afterwards, produce fresh seed. Now, if these be allowed to stand until the next spring, they will flower and shed their seeds, in spite of every possible attention, the flowers coming out early in April, according to the season; so that it is impracticable to prevent their increase by any other method than the one suggested. If this plan, however, be persevered in for a few years, the success is indisputable; though much depends upon performing the operation of pulling as early as the corns are cut; for, if that be delayed any length of time, the leaves wither and fall off, after which the roots cannot be easily discovered. If the weather be moist, there will be little difficulty in pulling up the roots to a sufficient depth; but should it be

* Naismith's Elements of Agriculture, p. 406.

† In Sir John Sinclair's Account of Scottish Husbandry, Vol. i, pp. 361, 362.

dry, or the ground hard, it is proper to furnish the pullers with a small piece of iron split at one end, like the toes of a hammer, and about ten inches long,* to enable them to get the root up to the required depth. A few boys or girls, under the direction of a careful overseer, will execute this work at a trifling expense; and care must be taken that all the roots, so pulled, be carried off and destroyed; for, if allowed to remain on the sides of stone walls or hedges, they will flower in the succeeding spring, and shed their seeds; which, being of a winged description, will fly about the field in all directions. Where land is much infested with this pernicious weed, it is proper to examine it in the spring months, lest any of the stalks should have escaped in autumn; and in this way, by attention and perseverance, ultimate success may be relied on."

It would greatly exceed the limits necessarily assigned to this section, were we to enumerate other weeds which annoy the industrious farmer; as the preceding are the most formidable and vexatious impediments to his labour, we have confined our attention to them. And, with respect to all other inesculent herbage growing on pasture grounds, as well as all weeds bearing winged seeds by the sides of roads, ditches, &c. we would remark, that they should invariably be cut down as soon as they begin to flower, in order to prevent their increase by their seeds being dispersed over the fields. A very strict attention in the selection of seeds will contribute to preserve fields from being over-run with weeds, when these are once pretty well eradicated.

IV. WOOD.—With regard to timber-trees, when they obstruct any of the operations of agriculture, it will be most advisable to eradicate them by means of the machine in use for that purpose, especial attention being given to clear away all their roots at the proper season of the year; and, with this view, Mr. Bentinck's contrivance for pulling up trees by the roots may, where the farmer can command it, be beneficially employed: its price, we understand, is *one hundred pounds*. In the case of *shrubs*, such as *furze* or *whins*, it is no unusual practice to set fire to these, and afterwards to grub them up; by which means much loss is sustained, not only from the valuable

* Mr. Baker's weed-extirpator, above described, might probably be employed with success, instead of this implement.

manure thus lost in the furze, but also by the loss of a valuable article of food for cattle, which (as already intimated, p. 119) will eat the tops, or shoots, of that shrub with avidity, when bruised for that purpose.

After furze, or any other shrub that forms an obstruction, has been grubbed up, it has been recommended by an able agriculturist, (Mr. Headrick, in "Communications to the Board of Agriculture," Vol. ii.), to admit sheep to pasture, which would effectually prevent such shrubs from growing again from the small roots left in the ground. But he thinks this experiment would be attended with yet greater success, if the land were thoroughly fallowed, and every root removed as soon as it appeared. After which the soil, being well manured with lime and undergoing a course of crops, might be sown with grass seeds alone; and, as soon as sheep could be admitted with safety, he would turn them in, as they would probably destroy the tender shoot of every plant as soon as it rose to the surface, and consequently keep the ground perfectly clear in future.

5. PLOUGHING.

Ploughing is one of the most important operations in agriculture, and ought to be executed with the greatest attention; hence every husbandman should see that it be well performed, as otherwise he may be irreparably injured by bad ploughmen. In regard to the times and seasons for ploughing, it may in general be remarked, that the latter part of autumn, or commencement of winter, is best calculated for most soils; because they are thus rendered capable of receiving a considerable degree of moisture for the ensuing summer; whereas, if land be turned by the plough in the spring and summer seasons, it invariably suffers much loss by the evaporation of its moisture. No marshy, stiff, or tenacious soil, however, ought to be ploughed while in a wet state; for the labour is thereby not only increased unnecessarily, but also the soil cannot thus receive any material improvement.

Concerning the depth and frequency of ploughing, agriculturists are by no means agreed; in fact, these points must necessarily be regulated by the nature and quality of the vegetables intended to be raised, and also by the nature and proper-

ties of land. And as, in a work of this nature, it is impossible to state or discuss every possible situation and circumstance connected with the subject of ploughing, we shall subjoin a few hints on this subject, on the authority of Mr. Young, (Farm. Cal. p. 509), an attendance to which will not be without some use to the young farmer.

1. "An additional depth should first be gained in autumn, that successive change of seasons may take effect in atmospheric influences, before any seed is ventured in the raw stratum first brought up.

2. "The quality of that stratum should be examined; it is sometimes steril, by reason of an acid discoverable by boiling in water, and putting that water to the test of blue infusions.

3. "Animal and vegetable manures cannot be *buried*; at whatever *depth* they are deposited, their constant tendency is to rise to the atmosphere.

4. "Fossil manures are extremely liable to be buried, having a constant tendency downwards. Chalk, marl, and clay are sufficiently soluble, or so miscible with water as to sink in a regular mass, and are sometimes found much below the path of the plough.

5. "In soils of a poor hungry quality, there should be some proportion observed between the depth of ploughing and the quantity of manure usually spread; but this does not hold good upon better soils.

6. "Soils are rarely found that ought not to be ploughed, in common, six inches deep; many ought to be stirred eight inches, and some ten.

7. "One deep ploughing (to the full depth) should be given once in twelve, eighteen, or twenty-four months: if this be secured, shallow tillage, by scaling, scarifying, scuffling, skimming, or broad-shaving, is in many cases preferable to deep working, oftener and especially for wheat, which loves a firm bottom."

Deep ploughing is recommended, 1. Where the first furrow is given to land, intended to be fallowed in the end of autumn and beginning of winter, and where grass or root weeds do not abound; in this case the soil is pulverized and sweetened by the frost;—and 2. In moorish or cold soils, as it affords a greater scope for the roots of plants to procure nourishment, admits the superabundant moisture to subside from their roots,

and prevents the summer drought from making an injurious impression on the growing crops : for on such lands, shallow ploughing exposes vegetation to be starved or drowned in wet weather, and to be scorched or withered in dry seasons.

On the contrary, deep ploughing is prejudicial, 1. Where rich old lays are broken up for cropping ;—2. When grass, only two or three years old, is broken up, more especially where it has been pastured with sheep ;* 3. When lime has been recently applied, as it has such a tendency to sink, from its own weight, and the moisture which it imbibes ;—4. When turnips have been eaten off the soil on which they grew. In all these cases from four to five inches deep will be found sufficient. And 5. If land be infested with grass, which generally runs much on the surface, the first ploughing should not be deep.

In addition to these hints we have only to observe, that the various preparatory ploughings ought, in most cases, to be deeper than those intended to be immediately followed by seed ; in which last case they should be slight, and the *plit*, or plough-slice, ought not to be laid over too much, in order that the seed may be perfectly covered. Further, lands that have been recently manured with lime or marl, do not require deep ploughing ; on exhausted soils, however, it is very beneficial, and on that account is generally recommended by the most experienced agriculturists.

The advantages derived from the use of the plough are very great ; the soil being opened for the reception of vegetable aliment from the air, the food of vegetables is consequently increased ; and, the surface, being thus enlarged, a larger portion of ground is exposed to the influence of the air. By rendering light lands firm, and breaking up such as are too solid, ploughing essentially contributes to ameliorate the earth, and

* This system of shallow ploughing requires to be particularly attended to, in ploughing land that is much infested with annual weeds : as, from the extreme condensation of the soil, by the trampling of the sheep, a furrow even of a moderate depth, *to appearance*, will make the plough penetrate below the staple, that had been cleared by the culture given during the previous fallow ; from which circumstance, myriads of the seed of annuals are raised to the surface where they vegetate, and materially injure the crop cultivated, besides replenishing the soil with a fresh supply of their own seeds. (Sinclair on Scottish Husbandry, Vol. i. p. 218, 219.) The whole of the paper on ploughing deserves to be studied with deep attention by every farmer.

extirpates noxious weeds, by exposing their roots to drought, so that they necessarily perish. And lastly, by forming the land into ridges, it tends to remove humidity, as the surface-water may discharge itself into the furrows, and be conducted thence by means of drains, or ditches, into some stream. Much attention, however, is necessary in forming ridges: if the soil be deep, these ought to be narrow; in more shallow situations they should be made broader; where there is a considerable declivity, they should be formed with a gentle slope, in a direction due north and south, in order that they may gradually carry off the water. And as the best and most fertile mould is collected in the tops or crowns, it will be necessary to manure the sides of the ridges, which would otherwise yield but indifferent crops. Consequently the ground will become nearly of equal fertility, so long as the ameliorating properties of the manure continue.*

6. HARROWING.—ROLLING.

After the land has been broken up, the aid of the harrow becomes necessary, in order to pulverize the soil more effectually as well as to eradicate weeds from the soil, and also for covering in the seed, after it has been committed to the earth. According to the nature of the soil, and the peculiar purpose for which this operation is required, the size of the harrows, scarifiers, or scufflers employed, necessarily varies. Hence, as we have already noticed (Chap. V. p. 267—273) the most effective harrows in modern use, we shall only observe, with regard to strong lands, that though they require more harrowing than lighter soils, in order to pulverize them, yet as all soils become more firm and solid by harrowing, the less strong lands are harrowed, if the intention be answered, the better. Such lands should also be harrowed during dry weather only, as the ground will become poached, and consequently more retentive of moisture. Light, spongy soils, on the contrary, particularly such as contain any portion of peat, being rendered more compact and retentive by this operation, can scarcely be harrowed too much; but this should by no means be done during ex-

* The principles above stated are fully illustrated in Sir John Sinclair's *Work on Scottish Husbandry*, Vol. i. pp. 156—171.

ceedingly hot and dry weather, because too large a portion of moisture will evaporate.

The mode or manner of harrowing depends on the nature of the seed sown and other circumstances. For grass seeds this operation should be performed very slightly, with a light implement, having short teeth; otherwise the seed may be put in too deep, and consequently will not vegetate. Where a field has been indifferently ploughed, and the ridges are raised in the middle, the harrow should pass first along such ridges, then across, and afterwards along them again; without this precaution, much seed would fall into the bottoms of the furrows, and would not vegetate. On the other hand, well-ploughed lands, the ridges of which are nearly level, may be harrowed either in the way above mentioned, or first across, and then along the ridges, as may suit the farmer's convenience.

Rolling is an operation of equal importance with harrowing, in reducing and pulverizing strong, heavy, and adhesive lands; while, by rendering loose soils more compact, the earth adheres more closely to the roots of plants, and thus promotes their growth. The season varies according to the nature of the soil. Thus, light lands may be indifferently rolled at any time after harrowing; but, on retentive and stiff soils, the roller can only be beneficially used when they are in a pretty dry state, because, during damp or wet weather, they would be greatly injured by the poaching of the team. Whereas, if the roller be employed on such soils in the intervals between the different harrowings, all lumps and clods that may lie on the surface will be effectually broken to pieces and pulverized, for the reception of seed. Lastly, the roller is of eminent use in the management of grass lands, over which it may be beneficially passed once early in the spring, a second, and if it be practicable a third time after irrigation; because the earth will not only be thus rendered more firm around the roots, but a uniformly smooth surface being obtained, such treatment will also greatly facilitate the future mowing.

7. IRRIGATION.

Water, forming by far the greatest portion of the sap of plants, is absolutely necessary to vegetation: hence, although

this fluid is very injurious to land when it soaks into or stagnates upon it, yet it makes a very great improvement upon land that is flooded with it, where there is plenty of running water that can be conveyed upon the land, and drawn off thence at pleasure.* Thus, suppose there is a piece of ground lying contiguous to, and somewhat lower than the river; some water being conveyed from the river to the higher parts of the land, will show where a carrier is to be cut, for conducting the water from the river to such higher places. These carriers, or carriages, as they are respectively termed, being filled till they run over throughout their whole length, drains are to be made in the lowest parts of the meadow, as nearly parallel to the carriages as possible. The design of these drains is to discharge the water into a large or main drain, which conveys it off the meadow.

In order to make the water run equally over the sides of the carriage, there are stops made in it at proper distances, by which the course of the water being obstructed, it rises a little and runs over the sides of the carriage. These stops are made with pieces of turf laid across the carriage, as high as the banks of it, next the sides, and lower towards the middle of it; which stops being of a proper height and distance from each other, (such height and distance to be determined by trials), the water will uniformly flow over all parts of the banks of the carriage.

These carriages should be made with a small ascent in the bottoms of them, from the river to the further end, and should all unite near the river, where a sluice is to be placed with gates or hatches; which being shut, to keep back the water coming from the river, and a small sluice in the side communicating with the main drain of the canal, opened at the same time, the water in all the carriages, or canals, will then return from the further end of the carriages, and, passing through this small sluice into the main drain, the carriages will thus in a short

* When land has been covered by water in the winter, or in the beginning of spring, the moisture that has penetrated deeply into the soil, and even the sub-soil, becomes a source of nourishment to the roots of the plant in the summer, and prevents those bad effects which often happen in lands in their natural state, from a long continuance of dry weather. Sir H. Davy's *Lecture on Agricultural Chemistry*, p. 351.

time be laid perfectly dry. The bottoms of the drains are, on the contrary, to be made highest next the river, and from thence deepening to a large drain at the lower end of the meadow; so that when the water ceases to run into them over the sides of the carriage, they will soon be emptied into the main drain, and thus the whole meadow will be laid dry.

When the meadow is to be watered again, the small sluice is to be shut, and the large one opened, which will admit the water from the river, and irrigate the meadow as before. The water should flow over the sides of the carriages, and over all the surface of the land lying between them and the drains, as equally as possible; and for this purpose, the earth dug out of the drains and carriages at first, and afterwards when they are scowered or cleansed, is to be laid upon the lower part of the ground, so that it may lie even and upon a regular descent to the carriages or drains. The soil thus dug or scowered out, also serves to repair the banks of the carriages.

Though the water flows equally over the surface of a water-meadow, the grass does not grow equally; but the crop is greatest towards the carriages, more of the rich sediment being deposited there than towards the drains; hence it is that the produce is greater where the carriages and drains are near together. The more numerous these are, the larger will the crops be, provided a sufficient proportion of water can be obtained.

The constructing of sluices is one of the principal articles of expense, partly because they are usually made of timber, a material which is subject to decay in the compass of a few years, whereas brick and stone cemented with terras, are equally proper and infinitely more durable; particularly when the sluices are constructed upon correct principles, so as to prevent them from being *blown up*, or the water from forcing a passage at the bottom;—a circumstance which, when it happens, often renders it necessary to re-build the sluices. It would be foreign to the plan and design of this work to detail the mode of constructing the sluices, stops, &c. necessary in the system of flooding land; we therefore at present observe, that the different works ought to be carefully examined and scowered out in autumn, and all necessary repairs made, and refer the reader to Mr. Boswell's very interesting "*Treatise on watering Meadows*," (8vo. 4th ed. 1801).

The preceding hints have been given on the supposition that

the land is perfectly level: but where its surface is very uneven the inequalities should be removed, though the expense be considerable, as the improvement will more than counterbalance the expense. A striking illustration of this remark occurred some years since in a small coarse meadow, which consisted chiefly of a peat soil, and out of which the peat had, in some places, been dug one or two feet deep, in others six or seven feet, and in some places not dug at all. Thus it remained for some years in pits, very irregular, and for the most part inundated with water, being contiguous to a river. In order to reclaim this unprofitable spot, the spirited proprietor first cut a large drain, in order to carry off the water, and then levelled the ground, laying it in straight, low ridges, about nine yards in breadth. Carriages were made on the tops of these ridges, and from thence to the furrows or drains; between the ridges the ground was laid upon a descent, about one inch to a yard; drains were also made in the furrows parallel to the carriages. A cut was then made from the river to let the water into the carriages through a sluice made in the cut, and a small one in the side of it, to let the water out of the drains, when the meadow was to be laid dry.

In performing this work, the greatest attention and accuracy were necessary, and were given; because the *dip* of the river was low, and the water often did not rise sufficiently high to fill the carriages; and, therefore, he could not raise the ridges to such a height, and give them so great a descent as he could have wished. For, it should be observed, where it can be had, the descent should be greater than here, in order that the water may flow quickly over the sides of the ridges; and, as then more water is required to be thrown over them, a large portion of fertilizing sediment is deposited upon the meadow, and the water has not time to soak into it to such a depth as it otherwise would; and thus the land is prevented from becoming chilled, and the herbage from proving to be coarse and rank.

The proprietor of the meadow in question not having enough of the turfy staple to lay upon the ridges all over the meadow, he was reduced to the necessity of laying on it promiscuously such earth as came to hand; and, as much time would thus necessarily have elapsed before a good turf could be formed, and a good crop produced, he therefore sowed it with hay-seed. He then let the water on and off gradually, till the works were

settled ; the earth and mud scoured out was laid upon the low parts of the banks and the surface of the meadow.

As the supply of water was often inadequate, so that it could not be thrown over the whole meadow at once, he was under the necessity of watering it in divisions ; having for this purpose made dams in the carriages, in proper places, so that he could turn the water on them at pleasure. This practice is worthy of notice, and deserves to be followed ; for where it may not be convenient on farms to have three or four meadows to which the system of irrigation can be applied, yet it will be found very advantageous to divide one large meadow into three or more *panes*, or parts ; for, as Mr. Boswell has justly remarked, while cattle are eating the first, the second will be growing, the third draining, and the fourth under water.

To return : notwithstanding all these inconveniences, the meadow in question produced, the third year after it was watered, one ton and a half of hay per acre at the first cutting, and was annually improving ; whereas, before that time, it was scarcely worth 2s. 6d. per acre. The expense was about 5l. per acre, the soil being very easily dug, especially where it lay under water ; and, as the improvement thus effected was very great, we trust the annexed plan will, together with its accompanying explanation, convey a more clear and intelligible idea of it than could be given by a mere verbal description.

will permit. To make the carriages deep would be of no use, because it is only the water at the surface that flows over the sides of the carriages. A carriage kept full, that has only six inches of water, will throw as much over upon the meadow as if the water in it were six feet deep. But besides, there is a damage in deep carriages; a larger body of water does by its weight force deeper into the ridges, which chills the land, and makes it produce flags, and other aquatic weeds, to the great injury of the hay.

The drains, *d r*, *d r*, are made between the ridges in the furrows, and parallel to the carriages: they are eighteen inches wide, and of a similar depth at the upper ends *d d*, and twenty-four inches wide, and the same depth at their lower ends *r r*.

The carriages, *c a*, *c a*, are widest (twenty-four inches) at their upper ends *c c*, to receive a sufficient quantity of water, and are gradually contracted from twenty-four to eighteen inches at their lower ends *a a*; by which contraction, the water being more and more confined, it rises a little, runs over the banks, and flows upon the grass on each side.

The drains, on the contrary, being made narrow at their upper ends, and widening, and also deeper towards the lower, they are on that account capable of receiving the accumulating water from the carriages, which they discharge into the large drain *r r*, to be conveyed out of the meadow at *n*.

The main drain, *m n*, is four feet wide, and is made to receive the water out of the carriages, through a small sluice at *O*, which is to be opened for that purpose, when the meadow has been sufficiently watered.

If the bottoms of the carriages were level from one end to the other, the water could not be drawn out of them, but would stagnate there, and chill the ground, and make it produce sedge, flags, and such coarse aquatic plants; for which reason the carriages are deeper towards their upper ends, next the river, by six inches, than at their further ends, *a a*. So that when the meadow has at any time been sufficiently watered, and is to be laid dry, by shutting the sluice at *S*, to prevent more water coming in from the river, and opening the sluice at *O*, the water begins immediately to run out of the carriages into the main drains, and are all emptied in a short time; and the water in the drains running off at the same time, the whole meadow is soon laid dry.

It is not necessary to continue the carriagès so far as the drain *rr*, but they may be made shorter, by three or four yards: for the water that runs over at the ends of the carriagès will spread, and flow over the intermediate spaces, from *aa* to the drain *rr*.

Where the water does not run over the sides of the carriagès, or not equally, stops are, as before observed, to be put into the carriage a little below, which will make the water rise a little above the stops, and flow over the bank. These stops are made with pieces of turf laid across the carriage, by way of a dam. The turfs are to be laid higher than the surface of the water next the banks of the carriage, but a little lower in the middle for the water to pass there: in this form 

The sluice *S*, by which this meadow is watered, is two feet wide, and three feet nine inches deep. While the meadow is watering, the hatch or gate of the sluice is drawn up about two feet and a half, and then the water passes through an aperture of five square feet; which, supposing it runs at the rate of two feet in a second, the quantity of water thrown upon this meadow is ten cubic feet in a second, or above 560 tons an hour. A much larger quantity would be more beneficial; though a less supply would make a considerable improvement.

Fig. 2.—*d, c, d*, is a section of one of the ridges; *c* the carriage on the top of the ridge, and *dd* the drains into which the water falls, after it has flowed over the land on each side from *e* to *d*.

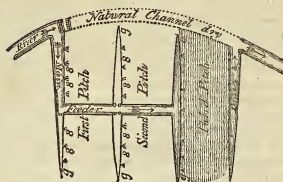
If there is not sufficient water to irrigate the whole meadow at once, it may be done in two or more divisions. As, suppose the part *w, c, m, p*, or about half of it, is to be watered first; make a dam across the main carriage at *c, p*, and then the part *w, o, p*, may be watered in the manner as already described: and the other part will remain dry. And, in order to water this other part by itself, make a dam across the main carriage at *o, m*, and at the upper ends of the other carriagès from *o* to *p*; the water being then let in from the river, will fill the other carriagès, and flow over this part of the meadow only.

These dams across some of the carriagès do very well occasionally; but where there is not a sufficiency of water, and a meadow must always be watered in divisions, it is the best way to put in small sluices in convenient places of the carriagès, to turn the water on and off the several divisions of the meadow at pleasure.

When the water has flowed over a meadow, and is all discharged, if there are any other meadows situated below it, they may also be flooded in the same manner as the first, and with the same water: and though the improvement of the lower meadows will not be so great as of the uppermost or first meadow, it will be considerable, and very well answer the expense and trouble of watering them: and in some places the water is thus thrown over several meadows in succession, for some miles.

Any meadows contiguous to a river may be watered, though not laid out in such an accurate manner as in this example. For if the river is a little higher than any part of such meadows, main carriages may be made, and the water conducted to the highest parts, and other carriages made branching from them, and between these the drains; which, though they cannot be cut quite parallel to the carriages, on account of the unevenness and irregularity of the ground, they will, notwithstanding, very well answer the purpose, to a great improvement; care being taken not to place the carriages, nor drains, too far asunder. The nearer they are together, so as there is room left to mow between them, the greater will be the improvement. Where there are any hollows, they should be filled, and the surface laid smooth, with the earth dug out of the drains, that the grass may be mowed very close.

There is another description of irrigation practised in the county of Gloucester, where it is termed *catch-work*. It is calculated for meadow and pasture lands, which lie on a steep declivity, or on the side of a hill. This method is denominated *catch*; because, when the whole is watered at once, the water, by the main cut or *feeder*, having attained the top of the piece of ground, floats over the uppermost pieces (in the language of irrigators, *pitches* or *panes*;) and is caught in (i. e. falls into) the floating gutters which distribute the water from one *pitch* to another, till at length the water reaches the bottom of the field, where it is received into a drain for the purpose of carrying it off, or conveying it to other lands situated on lower levels. In this method of watering, fewer cuts are necessary than in the mode of floating, above detailed; and these are made as nearly in parallel lines below each other as the bank will permit.



In this delineation of a catch meadow (selected from Mr. Wright's valuable "*Art of floating Land*," 8vo. 2nd Edit.) the lateral, horizontal, feeding gutters, which distribute the water over the first and second *pitches*, are represented as shut by sods or stones (8), consequently they appear dry. The whole body of water is represented as passing down the main feeder into the lowest floating gutter, whence it floats the lowest or third pitch, and is received into the drain at the bottom of the meadow, to be returned by it into the natural channel.

When the whole is to be floated at once, the obstructions (8) are taken from the lateral floating gutters, other obstructions being in the mean time placed in the main feeder, immediately under the floating gutters, in order to force the water into such gutters. But, in obstructing the main cut or feeder, care must be taken not to stop it *entirely*; but part of the water it contains should always be allowed to escape *in it* to the lowest panes, or pitches; for, supposing the main feeder to be entirely shut under the feeding gutter (g 1), so that the whole is made to run over the first pitch from such gutter and the horizontal part of the main drain, the water, filtrated through the grass of the first pitch, would be so much divested of its fertilizing qualities, as to be almost incapable of communicating any perceptible benefit to the pitches lying beneath. Water thus filtrated is, in the language of Gloucestershire irrigators, termed *used water*, and is regarded as next to *useless*; and hence it is, that the grass growing nearest to the floating gutters is most abundant, and of the best quality, in all kinds of meadows.

The proper breadth of the panes or pitches of catch-meadow, from gutter to gutter, is by no means correctly determined; but it should seem, that they ought not to be much broader than the distance from the floating gutter to the receiving drain in *float-meadows*, that is, from four to six yards. *Catch-meadows* is not held in such estimation, or so profitable, as float-meadow.

As, however, the expense attendant on the system of irrigation is necessarily very considerable, the young farmer should, in the first instance, calculate the obstacles he is likely to meet with in the progress of his work, either from the stream of which he designs to avail himself not being his property, or jointly his and another's; from his being prevented using it by the circumstance of intervening land belonging to others, of whom he must purchase a right to make a cut or feeder; or from water-mills, &c. Having obviated these inconveniences, his next step should be to take a level, by means of a spirit or water level, from the highest spot where the stream enters his property, following the dead level, and at every three or four hundred yards staking it out doubly, one stake on the dead level and another near it, descending so many inches as an allowance to give the water a current. Two inches in a mile will move it; though from twelve to twenty should be allowed, in order that the current may be sufficient. Should roads intervene, Mr. Young suggests, that they may be passed by the Italian method, which is to form a work of masonry to act as a syphon; the water is made to descend perpendicularly on one side of the road, in a brick or stone tunnel, to pass in an arch under the bed of the road, and rise on the other side in a similar tunnel, whence it passes on its course. But if the level be interrupted by farm-houses, gardens, cottages, &c. a much greater descent, per mile, must be allowed, in order that such interruptions may be gradually provided for.* Having ascertained these points, he will commence in such place as his judgment leads him to think best calculated for that purpose.

All lands that lie low and are contiguous to the banks of rivulets, brooks, and springs, are capable of being watered, particularly where the water-course is higher than the lands, and kept within its bounds by the banks; and if the current

* Farm. Cal. p. 301, where there are very many practical hints on this subject, which our limits will not permit us to notice.

have a very quick descent, the improvement by irrigation will be very great, attended with a comparatively small expense; because, in proportion to the greatness of the descent, the improvement is more speedy. But the lands most suitable for this purpose are, in Mr. Boswell's opinion,—1. a *Gravelly*, or sound, warm, firm, sandy soil; or, which is more frequently the case, a mixture of each, or almost any soil partaking of these qualities. Such soils, where there is a descent from the river, make an almost instantaneous improvement.—2. *Boggy*, miry, and rushy soils, which always occur near the banks of rivers, where the land lies pretty level, are capable of equal improvement with the other, when their respective values in an unreclaimed state are considered. In that state, indeed, swampy marsh-land is of little worth; but, by being judiciously watered and drained, it may be made to produce an ample crop of hay. More expense and judgment, he observes, are necessary to bring this sort of land into cultivation; which also, when very boggy, requires more and longer watering than any sandy or gravelly soils. The larger, however, the body of water is that can be brought upon them, the more beneficial will be the consequences, as its weight and strength will greatly assist in compressing the soil and destroying the roots of the aquatic weeds growing upon it. An instance of the benefit resulting from this practice, in soils of the above-mentioned description, has been communicated to the public by Mr. Turner, of Bognor, in Sussex. Having about six acres of peat ground, through the middle of which there is a stream, especially in winter, he ordered it to be cleaned, and what came out to be cast on one side only, that he might turn and keep the water over one half of the bog. He had then no other object in view but to keep the old ditch dry, for the more conveniently digging of the peat on the lower side of the bog; the water was thus continued for nearly two years, when part of the mound gave way, and, not having occasion to dig any more peat, the water resumed its natural course. The side where the water had run became a very tolerable meadow, the moss, rushes, and other aquatic vegetables being nearly gone; and it afforded such forward pasture, that he reckoned one year's grass to be worth more than it yielded for seven years before it was flooded.—3. Strong, wet, and cold clay soils are the most difficult to be improved by irrigation, not only from the dead level of their

situation, but also from their tenacity, which will not admit of being drained without great expense and attention. But when this can be effected, and a strong body of water can be thrown over them from a fertilizing river, in the winter, and a warm spring succeeds, Mr. Boswell states, that the crops of grass upon such lands are immense.*

In addition to these remarks, it may be observed, that springy land is by no means fit to be watered, until it is rendered firm and compact by a thorough draining; because, if it be springy and wet, the water thrown upon it will soak into it, and cause it to produce at best only a coarse and rank herbage. There is no doubt, however, but that the system of irrigation may be applied, in many cases, with most promising prospects of advantage to mountainous moors; yet there are no tracts, perhaps, so much neglected as these. At this unaccountable neglect, Mr. Young has justly expressed his surprise, because there are scarcely any situations that do not contain such spontaneous proofs of the benefit, "as," to use his own expression, "might have been sufficient for a hint to the *stupidest* clown." The firm spots by the sides of the torrents, from flooding, acquire a beautiful verdure, that proves a perfect contrast to the weariness of the surrounding waste; and where there are small rills on the mountain sides, which have not sufficient strength to work out a regular bed for their waters, but which spread, they are universally attended with a verdure (from the grasses subduing the heath, owing simply to the water,) which shows the advantage in the clearest manner. And he states, that he is confident that, with a little attention, out of twenty or thirty thousand acres of such land, which he has seen in the sister island, water might be thrown over *three* parts in four.

The principle recommended by Mr. Young, in order to effectuate this desirable improvement, is to throw over the sides of the mountainous tracts as much water, and with as much equality, as possible; carefully preventing that fluid from remaining in spots, and securing his works from being blown up by sudden floods, and heavy, impetuous rains.

The proper place for commencing this important work is, where there is a gentle declivity; then ascending as high as

* Boswell, on watering Meadows.

the water may be conveniently commanded, a stone wear must be made across a torrent, just sufficiently high to form a little basin among the rocks, if none occur executed by the hand of nature. From the spot where such a basin is found or made, a trench is next to be opened, the course of which will be directed by the spirit level: care being taken to give it only the necessary degree of fall for bringing the water in a very gentle current. The stream is to be made to overflow out of this carrier trench all the way it runs; the trench must be made gradually smaller to the end, as the body of water it brings lessens in proportion as it advances. Here Mr. Young recommends the undertaker to pause for one or two years, to see the effect of his labour, without increasing the evidently trifling expense described; and, if he find that effect to be great, as he probably will, he then advises all the spaces over which the water is thrown to be levelled to that exactness which is necessary for mowing ground; the water is next to be let gently over, when the ground will soon be covered with grasses and other beneficial plants, to the gradual but certain destruction of heath, and similar pernicious vegetables.

There is great difference in the quality of water, arising from the various particles of matter that are mixed with it. In general, those waters which breed the best fish are best adapted to the watering of meadows. Those rivers, which have a long course through good land, are impregnated with fine particles that are highly fertilizing to the adjacent meadows, which are casually overflowed by them, especially during floods, when the water is full of a rich sediment; for, though river water, when clear, may, by constructing weirs at a considerable expense, be raised sufficiently high to overflow the contiguous lands, and be of service to them; yet the improvement thus effected is by no means equal to that obtained from the same water when it is thick and muddy. Hence it has been suggested, that material advantage may be derived from raising the mud in rivers at any time, and carrying it in the current of the water upon such contiguous lands as are sufficiently low to be overflowed. Where water runs slowly, it deposits a considerable quantity of fine sediment, which may be raised by harrowing the bottom with common harrows, or strong thick bushes, loaded, and drawn by horses along the banks of the river. Cases have occurred, where lands have been thus im-

proved, which were situated far below the level of the mud, at a small expense; where there were carriages or carriers, made before, in order to distribute such thick water uniformly over the surface. The expedient above suggested has, indeed, long been practised in Lombardy, where a kind of heavy harrow is drawn along the bottom of the main carriers, for the purpose of disturbing the mud in autumnal, winter, and early spring irrigations; and the practice of throwing lime into the water has been successfully adopted in this country, the great divisibility of that fossil in water being well known.

The water running through poor soils is a very indifferent improver of land; and, if impregnated with mineral particles, (particularly of a ferruginous nature), it is destructive to most kinds of plants. Hence it will in no case be advisable to attempt a large improvement by irrigation, until the quality of the water be known; and this, in most instances, may be discovered by observing the effect it produces upon the herbage of the land which is sometimes inundated by it; and may be easily ascertained by watering a small piece of land with it, by way of experiment.

Rivulets and brooks, however, are (in Mr. Boswell's judgment) the streams that can be used to the greatest advantage; because the expense of erecting weirs across them will not be great, neither do any of those objections exist to which large rivers are liable. Besides, if they flow through a cultivated country, the land floods, occasioned by violent rains, bring a very large quantity of manure, such as chalk-water, sheep's dung, and the straining of arable fields, as well as the scowering of roads and ditches, the runnings of farm-yards, the drains and sinks from towns and villages, all of which are carried by the rains into smaller currents, and thence into the larger streams, where (if there are no watered meadows) they are totally lost to the farmer.*

Springs may likewise be beneficially employed on the coarse lands contiguous to them, if a sufficient quantity of water can be procured to flood such lands. The springs in question are the heads of brooks and rivulets rising out of a chalky or gravelly, sound and firm soil, in a cultivated part of the country, and not those which rise out of poor, heathy, or boggy

* Boswell, on watering Meadows, p. 8.

lands; for the water issuing from the latter is, in general, so small in quantity, always so very *lean* and hungry in quality, and often of an acid nature destructive of vegetation, that little if any advantage can be derived from them. But the former springs are invaluable; and every advantage possible ought to be taken to improve the lands lying near them. Of the beneficial effects produced by the springs first mentioned, Mr. Boswell gives a striking instance in a particular meadow that is watered by such springs, without any advantage from great towns, being situated only at a small distance below the head of the rivulet, which is supplied all the way by springs rising out of its bed as clear as crystal. The soil of the meadow in question is a good loam, several inches in depth, upon a fine springy gravel; and, whatever be the real cause, the fecundity of this water, he states, is beyond conception; for, when the meadow is properly watered and well drained, in a warm spring, the grass has frequently been cut for hay within *five weeks* from the time the stock was taken out of it, having eaten it bare to the earth. Almost every year it is cut in six weeks, and the produce varies from one to three waggon loads on an acre. In lands thus situated, in the mornings and evenings in the months of April, May, and June, the whole meadow will appear like a large furnace,—so considerable is the steam or vapour, which arises from the warmth of the springs acted upon by the sunbeams; and, notwithstanding the water is so uncommonly clear, yet, on being thrown over the land only for a few days during warm weather, by dribbling through the grass, so thick a scum will arise, and adhere to the blades of grass, as will be equal to a considerable quantity of manure spread over the soil, and (it may be fairly presumed from its effects) still more ameliorating. It should, however, be observed, that this scum must not be suffered to harden to a consistency like leather; which it will do, if the water be allowed to remain too long on the land, especially in warm weather.*

Further, *land floods* may be successfully applied to the important purpose of watering pasture lands; they will, indeed, be always found of great use where the sweepings of towns, farm-yards, &c. are carried down by them; and it rarely happens that any other erection is required, excepting a sluice,

* Boswell, p. 10, 11.

or small wear, to divert and convey them over the lands. Should the soil, however, be situated on the declivity of a hill, catch-drains often become necessary in order to water the lower part of the hill, after the water has been floated over the upper part. In many parts of this island, where there are large hills, or extensive rising lands, great quantities of water run from them into the valleys, after heavy or long-continued rains; these might, with proper attention, be collected together before they reach the bottom or flat ground, and thence be diverted to the purpose of irrigating the subjacent lands with great advantage to the occupier, and at the same time at a trifling expense. Should the land thus situated be arable, it may be beneficially converted into pasture, especially if ground of this description be a desirable object to the land-owner. The following method of employing land floods, for this object, is recommended by Mr. Boswell, whose classical treatise on watering meadows we have already had occasion to notice.

First, observe the piece of land or field best adapted to this purpose, both in point of soil and of situation. In case it be arable, it should be previously laid very level, and with the crop of corn all sorts of hay-seeds should be sown; and, as soon as a green sward is formed, it may be laid out. Next, in the lowest part of the ground, is to be drawn a deep ditch; in which the current may run through it; which ditch should be continued into some other ditch, or low part, in the subjacent lands, in order that the water may be freely carried off after it has been employed, and also while it is in use. Then let ditches be drawn above the field intended to be watered, aslant the sides of the hill, in such a manner that they may all discharge themselves into the head of the ditch above mentioned, just where it enters the field to be watered. A wear being then erected across this ditch, the field may be watered, according to the situation of the ditch, either in the middle or one side. It must then be conveyed by small *mains*, or trenches, and subdivided again by *branch-trenches*, according to the site of the field, and the quantity of water that can be collected. Of the immense advantages arising from water thus collected and distributed over land, (which is mostly a firm, good soil), those who are unacquainted with water meadows can form only an inadequate conception; for the water running down from rich cultivated hills, eminences, &c. carries along with it, during

very heavy rains, immense quantities of dung dropped by sheep and other cattle, and the manure spread on arable lands; which, being thus conveyed over the intended meadow with an easy descent, allows time for the particles of manure to subside upon the ground at one season, or to be filtered through the young grass as it dribbles through it at another; and the subsequent warm weather greatly accelerates vegetation. Meadows thus situated, Mr. B. remarks, would be vastly superior to any others, if they had the advantage of a constant stream; though, even under the present existing circumstances, they will prove to be very valuable, if every opportunity be taken to water them with every heavy rain, or land flood, that occurs. And he strenuously advises the occupier of such lands, on no account to lose time in appropriating them to this use, because such lands are healthy for *all* kinds of cattle, at almost all seasons; while the expense of converting them into this kind of water-meadow is exceedingly small, the subsequent annual charges are very trifling, and the produce is very considerable.* In addition to the benefit resulting from this mode of employing land floods, it may be remarked, that farm-yard liquor (which at present is often totally lost by evaporation) is capable, on elevated situations, of being applied in a similar manner, if it can be procured in sufficient quantity, though, in other situations, there is no doubt but that it may be artificially raised and diverted over the fields contiguous to the farm with the greatest benefit.†

In regard to the proper time for flooding or irrigating lands, it may be observed, that this valuable improvement may be performed at any period of the year; though winter and spring, or from the latter end of October to the beginning of March, are the two usual seasons for watering meadows; but experience and local circumstances are the best guides in this important operation. Supposing, therefore, that in October or November, which is the usual time in Gloucestershire, from heavy rains there is sufficient water for the whole number of

* Boswell, p. 97.

† This method of employing farm-yard liquor has been successfully attempted by Mr. Feana, whose interesting account, (which the protracted length of this article forbids us to state,) is accurately detailed in the "Communications to the Board of Agriculture," Vol. ii. p. 334—341, and illustrated with engraved plans.

meadows, (and, as already intimated, it is most advantageous to have three or four water-meadows if possible,) the mains, carriages, main-carriers, or feeders,—as the main-trenches are variously termed,—will be filled, and thence it will flow into the other trenches; when these are full, the edges of the mains, trenches, and drains are directed to be mown on both sides with a short scythe; when the water carries the dead grass, &c. as it is cut, down to the ends of the trenches, where it must be taken out with a fork, and thrown up into small cocks, to be carted off at the earliest opportunity. This necessary duty being performed, the operator, or *waterman*, goes up and down the main to see whether the water has risen to the requisite height; when any spots in the banks, that may be too low, should be raised to a proper level with small spits of green sward; and such as are too high must be pared down, so as to reduce the banks of the carriages or feeders to as accurate a level as possible, in order that the water may dribble properly over the meadow. The lateral and other trenches are to be frequently examined and levelled, or raised, and all obstructions removed, as circumstances may require, in a similar manner. The various drains must likewise be often inspected; if the water fill them, and rise over upon the edges, Mr. Boswell directs them to be widened, in case they cannot be made deeper; in this instance, however, very great floods are not to be regarded as the criterion, but a strong body of water.

Concerning the length of time during which the water is, at this period of the year, to continue on the land, there is a difference of opinion. Mr. Boswell thinks that the water may, with safety, be kept a month, or even six weeks, on corky, boggy soils, or strong clays; though a shorter period will be sufficient for a sandy or gravelly soil. But Mr. Wright (in his "*Art of Floating Land*,") is of opinion, that three weeks are sufficient for this purpose; we conceive, however, with Mr. B. that for the first-mentioned lands four or six weeks are not too much, because very boggy and swampy lands require more and longer watering than such as are of a drier nature. The larger the body of water that can be distributed over the former, the more beneficial will be the effects resulting from the practice of irrigation; for the weight and strength of the water will greatly assist, as already intimated, in compressing the soil, and also in destroying the roots of the aquatic weeds that vegetate on

it. Neither can the water, in Mr. B.'s estimation, be well kept too long upon it, especially in winter, immediately after the after-math is eaten, for the closer it is fed the better; and this kind of soil, when well watered and drained, will equal the wishes of the most sanguine in its improvement. On warm sand, or gravelly soils, (which are most profitable where they can be flooded at pleasure) a contrary practice must be adopted; the water ought on no account to be kept long at a time upon the land, but should be frequently shifted, the land well drained, and "thoroughly refreshed with it."*

In December and February, Mr. Wright advises the meadows to be laid dry, and to turn the water over it at night; otherwise, "if the water is suffered to remain for many days, a white scum arises, very destructive to the grass; which scum is raised chiefly when the sun is warm, and the water clear and thin. And if the land be now exposed, "without the covering of the water, to a severe frosty night, the greatest part of the grass will be killed;" whereas, by adopting the expedient above suggested, both these injuries, according to Mr. Wright, may be avoided. Or, the water may be taken off early in the morning; "and, if the day be very dry, the frost can do no injury, for it is only when the land and grass are wet, that the frost has this pernicious effect."

From this method of proceeding, Mr. Boswell, however, does not apprehend any dangerous consequences would arise. In regard to the supposed *fatal* effects of frost, the *contrary* appears to be the case; and the late Dr. Darwin (in his interesting work, intituled "Phytologia; or the Philosophy of Husbandry and Gardening,") has suggested, that irrigation, in this island, may prove serviceable in protecting grass and other vegetables from the too severe effects of intense cold during winter, or in the vernal season. With this view, he remarks, that the water of strong springs, (whose temperature is in this climate constantly 48° of Fahrenheit's thermometer) is preferable to river water, where a sufficient quantity of the former can be procured for the purposes of irrigation; the degree of cold in these two fluids being in a similar ratio with that of the atmosphere, till it declines to the freezing point, or 32°. Both river and spring waters, however, when distributed over the land, forming a thin

* Boswell, p. 32.

sheet of ice on its surface, are beneficial; inasmuch as they defend the roots of grasses from the severe effects of too intense cold, and thus preserve them in a more healthy state. And thus the quantity of grass, in this cold climate, may be materially increased; so that, under judicious management, the annual proportion will now be nearly double that produced under other treatment and other circumstances. In confirmation of Dr. Darwin's suggestion, we would remark the following fact: it often happens that the frosts of one night fix the *hatches*, or flood-gates, that admit water into the wears from rivers, so fast, that they cannot be removed until the frost breaks. Consequently, meadows are thus covered perhaps for several weeks with a sheet of ice, produced by a severe frost setting in while they are flooded; and after the frost is removed, those meadows always exhibit the *finest* verdure, and at the *earliest* period of the year.

With respect to the white scum above mentioned, it is clearly shown, by Dr. Darwin, to be generated by stagnation of water, and consequently is the *effect*, rather than the *cause*, of injury to the growth of grass plants. It may always be obviated while the weather is open, by suffering the water to dribble or trickle gently over the meadow from the higher parts: though, as Mr. Boswell justly observes, the rays of the sun are rarely found to be sufficiently strong, to have any effect upon the water in the month of February. Nor is it an uncommon thing, he adds, in that month, to have the water kept upon the meadows for a fortnight or longer.*

The system of watering, indeed, as recommended by that gentleman, appears to us preferable to any other; accordingly, after the lands have been floated four or six weeks, in November, (as already intimated, p. 335,) he directs the water to be turned out of one part of a field into another, and thence in the same into a third part, when it may be taken back again to the part first watered; a fortnight or three weeks will then be a sufficiently long time for the water to remain upon the ground. Thus, that fertilizing fluid may be continued shifting from place to place; care being taken to examine attentively the various works, and to remove all obstructions. As the days increase in length, and the weather becomes gradually warmer,

* Boswell, p. 117.

a proportionably less time (for instance, after Candlemas a fortnight, and the next turn a week,) will be fully adequate for the purpose.

These various operations will bring the season to the commencement or middle of March, at which time there will be an abundant bite of sweet pasturage. As, however, the management of meadows, after they are flooded, will be with more propriety discussed in a subsequent section of this chapter,* we shall, for the further information of our readers, subjoin a concise account of the American practice of watering land; and shall conclude the subject of irrigation with a brief statement of the numerous advantages that have already occurred, or which may be derived from a judicious and spirited adoption of this most important branch of rural economy.

According to the accurate inquiries of Mr. Strickland,† the practice of irrigation is known only in two parts of the United States, viz. Connecticut, and that tract in Pennsylvania in which the Germans have settled: but in neither of these places is it carried on to any considerable extent. The mode of applying the water is different in the two states:—In Connecticut, it is turned on the land as soon as the weather begins to become warm, in the spring; but it is not allowed to flow for more than twenty-four hours at a time. It is then taken off for a few days, then turned on again for twenty-four hours, and so on, till the meadow is nearly fit for cutting; immediately after which it is again applied in a similar manner for a second crop, and then again to force the after-grass in autumn; but it is always found to have the greatest effect upon the spring crop.

In this state, continues Mr. S., they also apply water to their lands in another very different and unusual manner; they flood great tracts of low meadows, situated on running water, just before the winter sets in, to the depth of two or three feet, by stopping the course of the stream, and thus let them remain covered till the spring, *in order to keep them warm, and defend them from the frosts.* In the following year, these lands produce a considerable quantity of coarse hay, which, in conse-

* Section VI. On the Management of Grass-land and Meadows.

† "Communications to the Board of Agriculture," Vol. ii. p. 165.

quence of the fine climate in summer, being very well got in, is eagerly consumed by the cattle in winter. After the hay is cut, these fields are pastured for the remainder of the year.

In Pennsylvania, the water is usually turned on the meadows about the middle of April, and is allowed to flow about two months; a few days after which, the ground having become dry, the crop is cut. As soon as the crop is off, the water is again turned on for three or four weeks, or till the land get a sufficient covering to defend itself from the sun, which, at that season, is very powerful. A second crop is then soon ready for the scythe; after which the water is allowed again to flow over it, till within a short time before it is wanted for pasturage, when it is turned off, that the ground may become sufficiently hard to bear the treading of the cattle without injury. Mr. Strickland has not been able to ascertain which of those two modes of applying the water may be most productive, as he has not seen the meadows of the Connecticut during the summer season; but those of Pennsylvania, he adds, bear abundant crops. But, since the introduction of clover, these meadows are falling fast into disuse, many of them having been ploughed up and converted into tillage, so that no further improvements can hereafter be expected in this branch of American rural economy.

The system of irrigation is carried on to the greatest extent in the counties of Wilts, Dorset, Hants, &c. and particularly in Gloucestershire, the farmers of which last-mentioned county are thus enabled to commence the making of *cheese* at least one month sooner than those of other districts, who have not the same opportunity. So highly, indeed, is water prized for this purpose in Gloucestershire, that the privilege of keeping up the water for turning corn mills, is regarded as a *grievance*; and those who have this privilege, obtain high rents for the temporary use of the water. In illustration of this circumstance it may be added, that on the river Churn, which is a branch of the Thames, there are ten corn-mills erected on a stretch of five miles of the water's course, which yield annually *four hundred pounds*. Upon the same stretch there are one thousand acres of meadow, supposed to be improved by irrigation to *two pounds* per acre of yearly rent above their former value, although they are of necessity but imperfectly watered from the obstruction of the mills; thus producing a

difference of *one thousand six hundred pounds* annual rent, in the different mode of using the water!!!

Further, not only are common meadows greatly enriched, and boggy lands reclaimed by the proper application of water, as already hinted, but also its utility is yet more clearly evinced from this circumstance, that, from the uncommon forwardness of the grass, the feeding between the months of March and May is worth one guinea an acre; in June, one acre of water-meadow will yield two tons of hay, which sells, at different times, from *twenty-five shillings* to *five pounds* per ton, according to the quality and quantity of the herbage, and the extent of the demand; and the eddish, or after-grass, may be valued at *fifteen* if not *twenty* shillings an acre, whether the season be wet or dry.

Upon the whole it is evident, that *irrigation* is not only a great improver of land, but is likewise capable of being carried on to the greatest extent in almost every situation, by seizing and making use of the various convenient situations afforded by nature, and by calling in the aid of machinery for conducting water into those situations where it would otherwise be impracticable to flood land. It ought not, however, to be concealed, that an apparently formidable objection has been started against this system of improvement, which may possibly produce unfavourable impressions in the minds of persons otherwise disposed to favour it, viz. that the great body of water thus constantly spread on the surface of the earth must necessarily render the surrounding atmosphere *humid*, and consequently prove injurious to the health of the inhabitants. But no such apprehensions need be entertained, provided the irrigation be properly conducted: as in this case the water is always in motion, and of course cannot possibly stagnate, or exhale any noxious vapours.

8. WARPING.

The improvement of land by *warping*, is one of the most singular that has ever been brought before the agricultural world; and its effects greatly exceed those produced by any other mode. It consists in admitting the tides of large rivers to deposit their sediment, or warp, and letting it run off again as the tide ebbs. Such is the aim and effect of this remarkable

process; but, in order to render it more efficacious, the water must be perfectly at command, so as to be excluded or admitted at pleasure. Hence it is necessary not only to cut a canal communicating with the river, but also to have a sluice at the mouth, which may be opened or shut as circumstances may require; while, in order that the water may be of a proper depth on the surface of the ground to be warped, and also for preventing adjacent lands from being overflowed, banks are raised around the fields to be warped, from three or four, to six or seven feet in height, according to circumstances. Thus, says Mr. Young, if the tract be large, the canal which takes the water may be made several miles in length: it has been tried as far as *four*, so as to warp the lands on both sides the whole way, and lateral cuts may be made in any direction for the same purpose; allowing the water longer time to deposit its sediment, because the effects decrease in proportion as it recedes from the river.*

The following practical hints for conducting the important process of warping, we give in the words of the Right Hon. Lord Hawke, selected from the "Survey of the Agriculture of the West Riding of Yorkshire."

"The land," observes his lordship, "to be warped, must be banked round against the river. The banks are made of the earth taken on the spot from the land; they must slope six feet; that is, three feet on each side of their top, or crown of the bank, for every foot of perpendicular rise: their top or crown is broader or narrower, according to the impetuosity of the tide, and the weight and quantity of water, and it extends from two feet to twelve; their height is regulated by the height to which the spring tides flow, so as to exclude or let them in at pleasure. In these banks there are more or fewer openings, according to the size of the ground to be warped, and to the inclination of the occupier; but, in general, they have only two sluices, one called the *flood-gate*, to admit; the other called the *clough*, to let off the water gently; these are enough for ten or fifteen acres. When the spring tide begins to ebb, the flood-gate is opened to admit the tide, the clough being previously shut by the weight of water brought up the river by the flow of the tide. As the tide ebbs, the weight or pressure

* Farm. Cal. p. 390.

of the water being taken from the outside of the clough next the river, the tide-water that has been previously admitted by the flood-gate opens the clough, and discharges itself slowly, but completely through it. The cloughs are walled on each side, and so constructed, as to let the water run off, between the ebb of the tide admitted, and the flow of the next; and to this point particular attention is paid. The flood-gates are placed so high as only to let in the spring tides when opened. They are placed above the level of the common tide.

"Willows are also occasionally planted on the front of the banks, to break the force of the tides, and defend the banks by raising their front with warp thus collected and accumulated; but these willows," Lord H. remarks, "must never be planted on the banks, as they would destroy the banks by giving the winds power to shake them."

The effect derived from warping differs greatly from that produced by irrigation; for it is the *mud*, and by no means the *water*, which produces the effect; so that in floods, and also during winter, this business entirely ceases. In fact its tendency is not to *manure* but *create* soil; hence the nature of the land is a point of little moment, almost every soil, whether peat, sand, bog, or clay, but especially light land, being equally benefited, as the warp raises it in one summer from six to sixteen inches in thickness; and, in low places, or hollows, two, three, or four feet, so as to leave the surface level. "Thus," Mr. Young observes, "a soil of any depth you please is formed, which consists of mud of a vast fertility, though containing not *much* besides sand; but a sand unique." From a careful analysis by an eminent chemist, warp consists of a large quantity of mucilage, a very little saline matter, and much calcareous earth; the residue is *mica* and *sand*, the latter in much the largest proportion, but both being in extremely attenuated particles; and Mr. Y. conjectures (though no notice is taken of any argillaceous ingredient) that some warp must contain clay, from the circumstance of its forming small clods and cleansing cloth from grease, not unlike fullers' earth. He adds, that in the opinion of a considerable *warp-farmer*, the stiffer sorts of warp are the best.*

A remarkable instance of the beneficial effects resulting from

* Agricultural Survey of Lincolnshire, p. 277. Farm. Cal. p. 392.

the practice of warping, occurs in the farm of Mr. Webster, of Bankside, which contains 212 acres, and is entirely warped. To evince the immense importance of this improvement, it may not be useless to state, that he gave 11*l.* per acre for the land, for which he would not at present take *seventy pounds* per acre: he thinks it worth 80*l.* and some parts even worth *one hundred pounds*; not that it would now fetch so high a sum. His whole expenses for sluices, banks, cloughs, &c. did not exceed 2,500*l.* or 12*l.* per acre; which may, indeed, be reduced to 1,000*l.* or 5*l.* an acre, as a neighbour below him has offered 5*l.* an acre for the use of his sluice and main cut, to water 300 acres. Estimating, however, at the highest sum, 12*l.*—11*l.* the purchase money, must be added, making the whole 23*l.* per acre; which, if he can sell at 70*l.* leaves a clear profit of *forty-seven pounds* per acre: a prodigious sum, which, Mr. Young remarks, is sufficient to prove that warping exceeds all other improvements.

Mr. Webster has warped to various depths, from eighteen inches to two feet, two feet and a half, &c.; and he has some moor land, which, previously to being warped, was worth only *one shilling and sixpence* per acre, that is now as good as the best land; and some of which would let at 5*l.* for flax or potatoes, and the whole for 50*s.* an acre. Our limits forbid us to enter into farther particulars respecting the efforts of this enterprising agriculturist; hence we shall only mention a few circumstances relative to the crops which his warped land has produced.

Of *potatoes* he has had from *eighty* to *one hundred and thirty* tubs, of thirty-six gallons per tub; selling the round sorts from *three shillings* to *three shillings and sixpence* the tub, and kidney potatoes from *five* to *eight shillings*. Six acres of *beans* yielded *thirty* loads, or *ninety* bushels per acre; and one acre (which was measured, in order to decide a wager) is stated to have yielded *ninety-nine* bushels: one bean, on four stalks, has produced 144 pods; and Tartarian oats have been seven feet in height. Mr. Webster warped one piece in 1793, which, in the following year, produced six quarters of oats per acre; white clover and hay-seeds were sown with the grain, and mown twice in the first year: the first cutting afforded *three tons* weight per acre, the second one ton, and after that appeared an immense eddish or after-grass. It ought, however, to be ob-

served, that warp brings weeds, especially mustard cresses, and wild celery, with abundance of docks, and thistles; but it destroys rushes and similar aquatic weeds.

The cost of a sluice for warping, that is five feet in height, and seven feet in width, is estimated by Mr. Young to be from four to five hundred pounds. Such a sluice will be adequate to the warping of fifty acres annually (Farm. Cal. p. 394); and, if the soil be contiguous to the river, it will be sufficient for seventy.

The practice of warping commences in the month of June, and is carried on throughout the summer; in fact, that is the only season in which this admirable improvement can go on, and therefore the agriculturist ought carefully to avail himself of every tide, and to keep his works in constant repair, that he may not (if possible) lose the benefit of a single tide through neglect, or any other untoward circumstance. This method of ameliorating land is at present chiefly confined to the farmers residing on the banks of the Don, Ouse, and Trent, to whom it proves a source of immense profit; hence it is highly probable, that the practice of warping may be successfully adopted on low lands adjoining to rivers, the tides of which are often impregnated with mud.*

SECTION III.

OF MANURES IN GENERAL, AND THEIR APPLICATION TO TILLAGE, GRASS, AND MEADOW LAND.

THE manuring of land is that operation, by which those substances are communicated to land from which vegetables can draw a sufficient degree of nourishment. Under the term *manure* is included every substance that is calculated to afford such nourishment, and to ameliorate the soil, either by remedying or improving its natural poverty, or by correcting its

* As it often happens that the various operations on land are done by the piece, by which means designing labourers have it in their power to impose on inexperienced farmers, we would recommend to their notice Mr. Cotes's "Surveyor's Guide," 8vo. recently published; in which the principles of land-surveying are laid down and illustrated with great precision and accuracy.

too great looseness, stiffness, or other qualities which retard vegetation.

Manures may be divided into five classes, *vegetable, animal, fossil, fluid, and compound*: each of these classes forms a distinct subject of consideration, to which we shall annex some remarks on the best modes of collecting and preserving manures, and their application to grass and tillage land.

I. VEGETABLE MANURES.

In this division either entire plants, or parts of vegetables, are comprehended, together with their ashes, roots, &c., which are sometimes turned in by the plough, while they are growing, or after they have been burnt, or otherwise decomposed.

1. *Vegetable ashes* are, in general, most effectual for manuring cold, marshy, boggy, moist, and uncultivated soils: thus, on all cold, clayey, or tenacious loamy soils, wood-ashes may be used with very good effect. The quantity laid on varies according to the crop intended to be taken. Mr. Young ("Bath Papers," Vol. x. p. 177,) has stated the average to be forty bushels* per acre; but of the various kinds of ashes in use, those of peat are, perhaps, best calculated both for grass and arable land. The most valuable are obtained from the slow combustion (similar to that of making charcoal) of the lowest stratum of peat, where the fibres and vegetable roots, of which peat consists, are most decayed. After the peat is collected into a large heap, and covered to prevent its flaming, it must be suffered to consume slowly, till the whole is completely incinerated, or reduced to ashes. Thus, burnt peat ashes, as well as those of fern, stubble, &c. may be applied with great advantage on sour meadows, where they destroy rushes and other aquatic weeds, and produce, instead of these, abundant crops of good grass: "their effect," Mr. Young remarks, "is greatest on dry, friable soils." On stiffer ones the quantity is larger; and, on some clays, they have been tried with very little effect. Peat itself may, however, be laid on clayey soils with great advantage; and the late Dr. Darwin has suggested,

* The strike bushel is invariably to be understood, unless a contrary standard be specified.

that its decomposition may be accelerated, by previously throwing it into heaps, either with or without the addition of lime, and afterwards by exposing it to the air, and drawing the superfluous moisture from it.

This suggestion of the late celebrated Doctor has been carried into execution upon a grand scale, in the county of Mid-Lothian, by Lord Meadowbank, one of the lords of session in North Britain; from whose very interesting tract* on the conversion of peat-moss into a valuable manure, we have selected the following important particulars. Several agriculturists have practised his Lordship's method of forming composts with the happiest success.

1. "All recently dead animal or vegetable matter, if sufficiently divided, moist, and not chilled nearly to freezing, tends spontaneously to undergo changes, that bring it at length to be a fat greasy earth, which, when mixed with sands, clays, and a little chalk or pounded limestone, forms what is called rich loam, or garden-mould.

2. "In vegetable matter, when amassed in quantities, these changes are at first attended with very considerable heat, (sometimes proceeding the length of inflammation), which, when not exceeding blood-heat, greatly favours and quickens the changes, both in animal matter, and the further changes in vegetable matter, that are not sensibly attended with the production of heat. The changes attended with heat, are said to happen by a fermentation, named from what is observed in making of ale, wine, or vinegar. The latter are ascribed to what is called *putrefactive fermentation*.

3. "Besides moderate moisture and heat, and that division of parts which admits the air in a certain degree, circumstances which seem to be necessary to the production of these changes, stirring, or mechanical mixture, favours them; and a similar effect arises from the addition of chalk, pounded lime-stone, lime, rubbish of old buildings, or burnt lime brought back to its natural state; and also of ashes of burnt coal, peat, or wood, soap-leys, soot, sea-shells, and sea-ware. And on the other hand, the changes are stopped or retarded by the pressure or consolidation excluding air; by much water, especially when below the heat of a pool in summer; by astringents; and by

* The tract here referred to has been privately printed, and is not intended for public sale.

caustic substances, as quick-lime, acids, and pure alkalies, at least their causticity is mollified, at the expense of the destruction of part of the animal and vegetable matter to which they are added.

4. "These changes are accomplished by the separation or decomposition of the parts or ingredients of which the dead vegetables and animals are composed; by the escape of somewhat of their substance in the form of vapours or gasses; by the imbibing also somewhat from water and from the atmosphere; and by the formation of compound matters from the re-union of parts or ingredients, which had been separated by the powers of the living vegetables and animals. The earlier changes, and in general those which take place previous to the destruction of the adhesion and texture of the dead vegetables and animals, appear to be rather pernicious than favourable to the growth of living vegetables, exposed to the direct effect of them; whereas the changes subsequent to the destruction of the animal and vegetable texture promote powerfully the growth of plants, and, partly by their immediate efficacy on the plants exposed to their influence, partly by the alterations they produce in the soil, constitute what is to be considered as enriching manure.

5. "It should be the object of the farmer to give his soil the full benefit of these latter changes, decompositions, and recompositions, which proceed slowly, and continue to go on for years after the manure is lodged in the soil. Even loam or garden-mould is still undergoing some remaining changes of the same sort; and, by frequently stirring it, or removing it, and using it as a top-dressing, its spontaneous changes are so favoured, that it will yield heavy crops for a time, without fresh manure; or, in other words, it is rendered in so far a manure itself; as it decomposes faster than in its ordinary and more stationary state, and, in so doing, nourishes vegetables more abundantly, or forms new combinations in the adjoining soil, that enable it do so.

"It should also be the object of the farmer to employ the more early changes, not only to bring forward the substances undergoing them into a proper state to be committed to the soil, but to accelerate or retard them, so as to have his manure ready for use at the proper seasons, with as little loss as possible, from part being too much and part too little decomposed;

and also to avail himself of the activity of those changes, to restore to a state of sufficiently rapid, spontaneous decomposition, such substances in his farm, as, though in a state of decay, had become so stationary as to be unfit for manure, without the aid of heat and mixture.

“ By attention to the two first particulars, and the proper use of compression, stirring, and mixture, the farm dunghill, though formed slowly, and of materials in very various states of decay, is brought forward in nearly the same condition. By attention to the latter, manure may, in most situations in Scotland, be tripled or quadrupled. On the other hand, by inattention to them, part of the manure is put into the soil unprepared, that is, in a situation where the texture of the vegetable is still entire; and, its decomposition never having been carried far by the heat and mixture of a fermenting mass, proceeds in the soil so slowly, that, like ploughed-down stubble, it does not merit the name of manure. Part, again, is apt to be too much rotted, that is, much of it is too nearly approaching to the state of garden mould, whereby much benefit is lost, by the escape of what had been separated during the process it has undergone, and the good effects on the soil of what remains are less durable; for, between solution in water, and rapid decomposition from its advanced state of rottenness, it is soon reduced to that of garden-mould; and, in fine, the powers of fermenting vegetable with animal manure, which, when properly employed, are certainly most efficacious in converting into manure many substances that are otherwise very stationary and slow in their decomposition, are lost to the farmer, so that he is often reduced to adopt an imperfect and little profitable mode of cultivation, from the want of the manure requisite for a better, though such manure may be lying in abundance within his reach, but useless from his ignorance how to prepare it.

“ *Peat-moss* is to be found in considerable quantities within reach of most farms in Scotland,* particularly in those districts where outfield land (i. e. land not brought into a regular course of cropping and manuring) forms the larger part of the arable land. It consists of the remains of shrubs, trees, heath, and

* And also in England, particularly near Newbury, in Berkshire; and also near Gatton park and Frimley, Surrey; beside many other places that might be specified.

other vegetables, which, under the influence of a cold and moist climate, and in wet situations, have got into a condition almost stationary, but much removed from that of the recently-dead vegetable, and certainly considerably distant from that of garden mould. It is no longer susceptible of going of itself, though placed in the most favourable circumstances, into that rapid fermentation, accompanied with heat, which masses of fresh vegetables experience; but it is still a powerful fuel when dried; and, on the other hand, it requires long exposure to the seasons, in a dry situation, before, without mixture, it is fit for the nourishing of living vegetables.

“In general, however, there is nothing in the situation of peat-moss, or in the changes it has undergone, that leads to think that it has suffered any thing that unfits it to be prepared for manure. It is no doubt found sometimes mixed with particular mineral substances, that may be, for a time, pernicious to vegetation; but, in general, there is no such admixture, and, when it does take place, a little patience and attention will be sufficient to cure the evil. In the ordinary case, the only substances found in peat that may be unfavourable to vegetation, in so far at least as tending to keep it stationary and prevent its rotting, are two, and both abounding in fresh vegetables of the sorts of which moss is chiefly composed: these are, gallic acid, and the astringent principle, or tan; and as these are got the better of in fresh vegetables by the hot fermentation to which they are subject, so as to leave the general mass of the substances to which they belonged properly prepared manure, there is no reason to suppose, that the same may not be accomplished with the acid and tan of peat. Again, the powers of peat, as a fuel, and of peat-ashes as a manure, ought to convince every person, that the material and more essential parts of the dead vegetable, for the formation of manure, remain entire in peat. Here the inflammable oils and carbonaceous matter which abound in the fresh vegetable, and the latter of which also abounds in garden-mould, remain entire; the soot and ashes, too, which are the results of the inflammation of each, seem to be nearly equally fertilizing; and, in short, little seems to be lost in peat but the effects of the first fermentation in preparing the matter to undergo its future changes with the rapidity requisite to constitute manure. Besides, the soil produced from peat-earth, by exposure for a course of

years, seems not to be sensibly different from that obtained from dung in the same way. Both are deficient in firmness of texture; but are very prolific when mixed with clays, sand, and calcareous earths, in due proportion.

"From considering the preceding circumstances, and from trying what substances operated on tan, and on the acid found in peat-moss, it was determined to subject it to the influence of different sorts of fermenting dung, with due attention to the proportions used, and to the effects of the different preparations; and the following is the direction which an experience of six crops recommends to practice.

"Let the peat-moss, of which compost is to be formed, be thrown out of the pit for some weeks or months, in order to lose its redundant moisture. By this means, it is rendered the lighter to carry, and less compact and weighty, when made up with fresh dung, for fermentation, and accordingly less dung is required for the purpose, than if the preparation is made with peat taken recently from the pit.

"Take the peat-moss to a dry spot, convenient for constructing a dung-hill, to serve the field to be manured. Lay it in two rows, and dung in a row betwixt them; the dung thus lies on the area of the compost-dunghill, and the rows of peat should be near enough each other, that workmen, in making up the compost, may be able to throw them together by the spade, without wheeling. In making up, let the workmen begin at one end. Lay a bottom of peat, six inches deep, and fifteen wide, if the ground admit of it. Then lay about ten inches of dung above the peat; then about six inches of peat; then four or five of dung, and then six more of peat; then another thin layer of dung; and then cover it over with peats at the end where it was begun, at the two sides, and above. It should not be raised above four feet, or four and a half feet high, otherwise it is apt to press too heavily on the under part, and check the fermentation. When a beginning is thus made, the workmen will proceed working backwards, and adding to the column of compost, as they are furnished with the three rows of materials, directed to be laid down for them. They must take care not to tread on the compost, to render it too compact; and of consequence, in proportion as the peat is wet, it should be made up in lumps, and not much broken.

"In mild weather, seven cart-loads of common farm-dung,

tolerably fresh made, are sufficient for twenty-one cart-loads of peat-moss; but in cold weather, a larger proportion of dung is desirable.* To every twenty-eight carts of the compost, when made up, it is of use to throw on above it a cart-load of ashes, either made from coal, peat, or wood; or if these cannot be had, half the quantity of slack lime may be used, the more finely powdered the better. But these additions are no ways essential to the general success of the compost.

"The dung to be used should either have been recently made, or kept fresh by compression, as by the treading of cattle or swine, or by carts passing over it. And if there is little or no litter in it, a smaller quantity will serve, provided any spongy vegetable matter is added at making up the compost, as fresh weeds, the rubbish of a stack-yard, potato-shaws, sawings of timber, &c. And as some sorts of dung, even when fresh, are much more advanced in decomposition than others, it is material to attend to this; for a much less proportion of such dung, as is less advanced, will serve for the compost, provided care is taken to keep the mass sufficiently open, either by a mixture of the above-mentioned substances, or if these are wanting, by adding the moss piece-meal, that is, first mixing it up in the usual proportion of three to one of dung; and then, after a time, adding an equal quantity, more or less, of moss. The dung of this character, of greatest quantity, is shamble-dung, with which, under the above precautions, six times the quantity of moss, or more, may be prepared. The same holds as to pigeon-dung, and other fowl dung; and to a certain extent, also as to that which is collected from towns, and made by animals that feed on grains, refuse of distilleries, &c.

"The compost, after it is made up, gets into a general heat, sooner or later, according to the weather and the condition of the dung: in summer, in ten days or sooner: in winter, not

* Mr. Thomson of Bewlie, in the county of Roxburgh, follows Lord Meadowbank's directions as nearly as possible, in the making of compost dung-hills; but when he has abundance of dung, he puts only two or two and a half cart-loads of moss, instead of three to one cart-load of dung. From this compost he has raised as good turnips as from dung alone, and from it has raised as good crops of wheat after fallow, to the extent of 40 or 50 acres per annum, as from dung. He has on his farms plenty of peat-moss; and when it is within the reach of arable land, he can, from experience, recommend the moss-compost as a great acquisition to farmers. Sir J. Sinclair on Scottish Husbandry, Vol. i. p. 210.

perhaps for many weeks, if the cold is severe. It always, however, has been found to come on at last; and in summer, it sometimes rises so high, as to be mischievous, by consuming the materials, (fire-fanning). In that season a stick should be kept in it in different parts, to pull out and feel now and then: for if it approaches to blood-heat, it should either be watered, or turned over; and on such an occasion, advantage may be taken to mix it with a little fresh moss. The heat subsides after a time, and with great variety, according to the weather, the dung, and the perfection of the making up of the compost; which then should be allowed to remain untouched, till within three weeks of using, when it should be turned over, upside down, and outside in, and all lumps broken: then it comes into a second heat: but soon cools, and should be taken out for use. In this state, the whole, except bits of the old decayed wood, appears a black, free mass, and spreads like garden-mould. Use it, weight for weight, as farm-yard dung; and it will be found, in the course of cropping, fully to stand the comparison.

“The addition recommended of ashes or lime, is thought to favour the general perfection of the preparation, and to hasten the second heat. The lime laid on above the dung-hill, as directed, is rendered mild by the vapours that escape during the first heat.

“Compost, made up before January, has hitherto been in good order for the spring crops; but this may not happen in a long frost. In summer, it is ready in eight or ten weeks; and if there is an anxiety to have it soon prepared, the addition of ashes, or of a little lime-rubbish of old buildings, or of lime, slaked with foul water, applied to the dung used in making up, will quicken the process considerably.

“Lime has been mixed previously with the peat; but the compost prepared with that mixture, or with the simple peat, seemed to produce equally good crops. All the land, however, that it has been tried on, has been limed more or less, within these twenty-five years.

“Peat prepared with lime alone has not been found to answer as a good manure. In one instance, viz. on a bit of fallow sown with wheat, it was manifestly pernicious.”

Another very simple process, by which peat-moss earth may be rendered valuable as a manure, has been discovered by Dr.

Rennie, of Kilsyth. He proposes, "that it shall be laid along side of a pool formed for receiving the juice of the dung-hill. For ten days it ought to be saturated with that liquid, occasionally turning it during the process of watering: it should then be allowed to lie in a thick heap, and to acquire a very gentle, almost an imperceptible degree of fermentation, after which it is fit for application."* By the abstraction of its juices, however, Sir John Sinclair remarks, the dung-hill would be greatly deteriorated. But, as in almost all yards belonging to extensive farms, there is a surplus of dung-hill liquor which oozes from the dung-heaps, we conceive that *this* fluid might be very beneficially applied in the manner Dr. Rennie proposes, where peat-moss can be commanded.

The quantity per acre of peat ashes is stated by Mr. Malcolm ("Compendium of Modern Husbandry," Vol. ii.) to be as follows: On strong retentive lands for *pasture*, twelve bushels top-dressed: On *lighter loams*, for pasture ten bushels, and for barley twelve bushels, ploughed in. On *sandy loams*, for pasture or clover eight bushels, for turnips or barley ten bushels, ploughed in. And on *chalky loams*, for pasture or seeds, eight bushels, and for barley or turnips nine bushels, respectively ploughed in. In autumn for the grass crops, in the spring for grain.

1. *Straw*, when reduced to ashes, has been spread with great benefit on land, in the proportion of four, five, or six tons per acre; this species of manure has been chiefly employed in Yorkshire, as a dressing for turnips; but as straw may be advantageously employed in soiling cattle during the winter season, it has been suggested to collect and stack the *stubble* which cattle will not eat, and burn it before sowing turnips.

2. *Dry-straw*, of wheat, oats, barley, beans, and peas, and spoiled hay, or any similar kind of dry vegetable, is (Sir H. Davy remarks), in all cases, an useful manure, though he doubts the propriety of indiscriminately adopting the usual practice of making such substances to ferment before they are employed. It is certain, that plants derive nourishment from the straw of different crops, when immediately ploughed into the ground; but there is an objection to this method of using straw, from the difficulty of burying long straw, and from its rendering the husbandry foul.

* Sir J. Sinclair on Scottish Husbandry, Vol. i. p. 210.

"When straw is made to ferment, it becomes a more manageable manure; but there is likewise, on the whole, a great loss of nutritive matter. More manure is, perhaps, supplied for a *single* crop; but the land is less improved than it would be, supposing the whole of the vegetable matter could be finely divided and mixed with the soil."* Instead of the usual practice of carrying straw that can be employed for no other purpose to the dunghill, there to ferment and decompose, Sir H. Davy suggests it as an experiment worth making, whether straw may not be more economically applied when chopped small, and kept dry till it is ploughed in for the use of a crop. In this case, though it would decompose much more slowly, and produce less effect *at first*, yet he conceives that its effects would be much more lasting.

3. *Weeds*, in general, are likewise of great service, particularly, if they be cut down in their most succulent condition, shortly before they flower; as they are then not only most disposed to putrescence, but also the injury that would otherwise result from the germination of their seeds will thus be effectually avoided. Hence weeds ought not, as is too frequently the practice, to be heedlessly burnt or thrown into the highway; but, if they be spread on the ground in their juicy state, in heaps, and occasionally turned over and covered with soil, they will certainly perish and speedily become putrid. The application of quicklime to weeds will also greatly promote their decomposition: for this purpose it has been recommended by Mr. Brown, of Derby, to form a stratum or layer of green vegetable matter, about one foot thick; on this is to be scattered a thin layer of powdered lime, continuing such strata till the pile is of sufficient height. In the course of a few hours, a decomposition of parts will take place, when the heaps should be covered with a few earthen sods, or a little addition of vegetable matter, to prevent the mass from taking fire; at the end of twenty-four hours the dissolution of the vegetable matter will be complete, and a quantity of excellent ashes will be obtained, ready to be immediately spread on the land. Dry *vegetable* recrements may be treated in a similar manner, by previously keeping them in a state of moisture, in order to accelerate their decay; but without suffering water to become

* Sir H. Davy's Lectures on Agricultural Chemistry, p. 284.

stagnant upon them, or allowing cattle to trample too much upon them in the yard.

4. *Sea weed* is another vegetable manure that may be used with the greatest profit, where the situation of a farmer gives him access to this material. The best mode of applying seaweeds is to cut them, while in their most succulent state, from the rocks on the sea-coast, and *immediately plough them in*; because much of their enriching matter will be dissipated by exposure to the air. Where, however, they cannot be procured in their juicy state, it will be advisable to collect the weeds when thrown on the shore, and also plough them in immediately; or if they be not wanted for speedy use, they may be formed into heaps, with thin strata of lime, and treated in the manner already suggested with regard to weeds in general. This manure, however, is transient in its effects, seldom if ever lasting more than a single crop; which is easily accounted for from the large quantity of water, or of the elements of water, which it contains.* Sir J. Sinclair states, that it should never be applied on ground for turnips after March, as it rarely incorporates with the soil in such a way as to insure a good crop: and if the weather be not moist in summer, he thinks it is, probably one cause of breeding the fly which is so destructive to turnip crops.†

5. *River or pond weeds* are capable of a similar application, and with great benefit, on loose, sandy soils intended for turnips; though it is to be observed, that such weeds have no effect whatever on wet springy lands, or on those which are liable to be inundated. The proportion to be laid on is twelve or fourteen loads ‡ an acre.

6. *Rape, or cole-seed cake* reduced to a coarse powder, after all the oily particles have been expressed from the seeds, is also said to be a useful manure as a top dressing for turnips: it is usually scattered by hand, and harrowed in with the seed of the intended crop. On account of its unusual dryness, this sort of manure is best used in *moist seasons*, when the

* Sir H. Davy's Lectures on Agricultural Chemistry, p. 282.

† Sir J. Sinclair on Scottish Husbandry, Vol. i. p. 205.

‡ Throughout this chapter, and where the subject of manures is noticed; the load of twenty-seven bushels (or one cubical yard) is intended; unless the contrary be expressed.

rain disposes it more speedily to decomposition; the quantity to be spread varies from four to five quarters per acre. It should be used fresh, and kept as dry as possible before it is applied.

7. *Malt-dust*, or the refuse which is screened from malt in drying, affords an excellent vegetable manure, particularly the *black dust*; because, in this last sort, the seeds of charlock, with which it usually abounds, are completely destroyed by exsiccation. For grass lands it is very beneficial, in the proportion of sixty bushels per acre; but it is best calculated for cold clays, or stiff loamy soils, as in gravelly situations it is apt to burn the soil. Should, however, the ensuing weather be wet, malt-dust will be very useful, as it is washed into the ground by the first shower, and an abundant crop is secured, while the vegetation of noxious weeds (that are usually generated by the use of common dung) is effectually prevented. Like rape-cake, it should be used as dry as possible, and its fermentation prevented.

8. *Oak bark*, or (more correctly speaking) *tanners' waste*, may be accumulated into small heaps, and mixed with lime and a sufficient degree of water to keep it moist, and promote its decomposition and putrefaction. It is an excellent manure for cold, stiff soils, whether arable or grass land; but, for the latter, it should be made to approach the nature of vegetable mould as much as possible. The best time for spreading it on grass lands is shortly after Michaelmas, that the winter rains may wash it into the ground; as, if it be applied in the spring, it will burn the grass, and exhaust rather than improve the soil for that season.

9. Considerable benefit has likewise been derived from ploughing in tares, rape, vetches, early-sown buck-wheat, and other succulent vegetables; but, whatever the vegetable may be, it ought to be ploughed in, says Mr. Young, with a skim-coulter plough, which is the only means of turning it so completely in as to conceal it entirely from the eye. The best period of the year for this purpose is, when the plants are in flower, or just as the flower is beginning to appear, which in general is about midsummer: for not only are the plants at this period in full crop, and consequently contain the largest quantity of nutritive matter; but the warmth of the weather will also very materially promote the decomposition. "Green

crops, pond-weeds, the paring of hedges or ditches, or any kind of fresh vegetable matter, require no preparation to fit them for manure. The decomposition slowly proceeds beneath the soil. The soluble matters are gradually dissolved, and the slight fermentation that goes on, checked by the want of a free communication of air, tends to render the woody fibre soluble, without occasioning the rapid dissipation of elastic matter.* The ploughing in of green crops, as a dressing for turnips, ought to be done at least three weeks before the seeds of those valuable roots are sown, when that seed should be lightly harrowed in. But *turnips* themselves, when, through any unforeseen accident, they are injured by frost, may be treated in this manner with great benefit to the succeeding crop, as they are believed to prevent the germination of the seeds of weeds found in dung; and, when stirred among the latter, the turnips accelerate their putrefaction.

“When old pastures are broken up and made arable, not only has the soil been enriched by the death and slow decay of the plants, which have left soluble matters in the soil; but the leaves and roots of the grasses living at the time, and occupying so large a part of the surface, afford saccharine, mucilaginous, and extractive matters, which immediately become the food of the crop, and the gradual decomposition affords a supply for successive years.”

10. *Wood soot* is a very beneficial manure for cold clayey soils, which are either in pasture or laid down in tillage for grain or pulse; it is of a black shining colour, emits a disagreeable odour, and has a nauseous acid taste. The proportions per acre are stated by Mr. Malcolm to be;—on *light loams*, for pasture, from twenty-two to twenty-four bushels; for barley, from thirty-three to thirty-eight bushels; for turnips, from thirty-three to thirty-six bushels;—on *chalky loams*, for pasture, from twenty-three to twenty-six bushels; for turnips, from thirty-three to thirty-eight bushels; for barley, from thirty-five to forty;—and on *strong loams*, for pasture, from twenty-two to twenty-six bushels; for artificial grasses (or, more correctly, for green crops), from twenty-eight to thirty-four bushels.

11. *Furze ashes* possess various degrees of strength, accord-

* Sir H. Davy's Lectures on Agricultural Chemistry, p. 280.

ingly as they are burnt in the lime or brick kiln, or in the oven: the best, however, are indisputably those which are burnt in the kiln, on account of the calcareous matter that combines with them during the process of combustion.* On meadows that abound with coarse grass or rushes, in consequence of stagnant surface waters, the application of furze ashes burnt in the lime kiln (together with keeping the drains open) will be found of great service; but for worn-out or neglected upland pastures, as also on light loams and silicious soils, ashes from the brick-kiln are preferable, either as top-dressings or ploughed in; and on stiff, loamy soils, with a substratum of chalk, the pure ashes, or such as are burnt in the oven, will prove very beneficial as top-dressings. The following proportions, per acre, are used in Surrey and the adjoining counties:—On *light loams*, for pasture, ten loads as a top-dressing; for turnips ten; and barley twelve loads, ploughed in.—On *strong loamy soils*, for pasture, ten loads, top-dressed.

2. ANIMAL MANURES.

On account of the rapid tendency to putrefaction of animal substances, when divested of the vital principle, they have been found to afford the most ready and abundant nutriment to vegetables. The first we shall mention is,

1. *Dung*, of which that dropped by fat cattle is justly remarked by Mr. Middleton, in his "Agricultural Survey of Middlesex," to be richer, and of course to possess more fertilizing properties, than the dung of lean cattle. Thus the dung of those fed with rape, linseed, or other oleaginous seeds, is the richest: that of animals supplied with oil-cake, or those seeds, of which the oily matter has been expressed, is next in point of fructifying powers: then the dung of cattle fed on roots; next that of such as are supplied with hay, varying according to the goodness of their keep; and that of straw-fed cattle, especially lean beasts, is the poorest of all.

With regard to the relative powers of animal dung, it may be observed, that *horse-dung*, when not too new, is admirably

* Malcolm's Compendium, Vol. ii. p. 134.

calculated for cold, steril, and poor ground; while that of neat cattle is better adapted to hotter soils; but both, when combined together, or with mud, form a useful manure for either of those soils. For cold clays, the dung of *swine* is conjectured to be of a fatter and richer nature than that of any other beast, and is said to be particularly excellent for grass lands, *one* load of hog's dung being averred to be more fertilizing than *two* of any other animal excrement. The *pulverized* dung of *deer* and *sheep* (the properties of which do not materially vary) is, in the judgment of agriculturists, best calculated for cold clays; the quantity per acre is from four to five loads, to be thinly scattered over the autumnal, or vernal crops, in the same manner as ashes.* The dung of poultry, particularly of *pigeons* and *geese*, is of great service in the improvement of meadows; especially that of the last-mentioned fowls, which is asserted to contribute to the fattening of sheep in a very material degree, those animals being most partial to, and thriving best on, pastures that have been manured with *goose-dung*.† It should be laid on as new as possible.‡ Lastly, the *soil*, or excrementitious matter of privies, is believed to excel every other species of manure, for the first year of its application; in the second, Mr. Middleton states, ("Transactions of the Society for the Encouragement of Arts," &c.), that its beneficial effects are less evident; but in the third, they nearly, if not altogether, disappear. The proportion for land in good condition is estimated by Mr. M. to be about two loads annually; which, he thinks, will always preserve its fertility. He adds, that exhausted land may be perfectly restored by the application of four or five (Middlesex) loads of such soil on each acre for the first year, after which two loads annually will be sufficient to retain the land in a high state of cultivation; and that the herbage produced by land thus manured, is capable of fattening the largest cattle in a

* The common mode, however, of applying sheep's dung is by *folding*, a practice, the utility of which has been already discussed: but it should seem, that most of the benefit thus obtained is derived from the consolidation of land affected by their treading, and from their urine: to which may, perhaps, be added the perspirable matter exuded from their fleeces while lying down upon the ground.

† Sir H. Davy is of opinion that, as the soil in woods where great flocks of wood-pigeons roost, is often highly impregnated with their dung, it would form a valuable manure. Lectures, p. 299.

smaller compass of time than any other. It will, however, be advisable, on account of the generally fluid state in which the excrementitious matter of privies is usually found, to combine it with some peaty or earthy matter, which the volatile alkali, evolved by the decomposition of the ordure, may reduce into the requisite degree of solubility, for facilitating the growth of plants; thus, much benefit will be derived, both in the quantity and quality of the manure.*

The disagreeable smell of night-soil may be destroyed by mixing it with quick-lime; and, if exposed to the atmosphere in thin layers strewed over with quick-lime in fine weather, it speedily dries, is easily pulverized, and in this state may be used in the same manner as rape cake, and be delivered into the furrow with the seed. The Chinese method of mixing night-soil with one third of its weight of fat marl, is worth a trial. Made into cakes and dried by exposure to the sun, it forms a common article of commerce, having no disagreeable smell, in that vast empire.†

2. *Urine*, or the liquor of farm-yards, is a fluid capable of being employed with great benefit both on *meadows* and on *arable lands*, which renders them uncommonly fertile. It should be used as fresh as possible, as the soluble animal matter it contains, is destroyed by putrefaction; and, if not mixed with solid matter, should be diluted with water, as, when pure, it contains too much animal matter to form a proper fluid nourishment for absorption by the roots of plants.‡ When applied to *meadows*, the best time for *sprinkling* urine is during the winter, when the rains will wash the fertilizing saline particles into the soil; or, the land may be sprinkled early in the spring, when it is laid up for hay; because no cattle will touch the grass, so long as the salt adheres to the blade. Another circumstance necessary to be attended to, in order to make the most of this valuable manure, is, that it be carried to the meadow or pasture, intended to be watered, in dry weather, as the farm-yard liquor

* For this interesting fact, we are indebted to the Earl of Dundonald's valuable "Treatise on the Connexion of Agriculture with Chemistry," 4to.; a work deserving the attention of every intelligent agriculturist.

† Sir H. Davy's Lectures, p. 298.

‡ Sir H. Davy's Lectures, p. 295. Sir J. Sinclair confirms his statement. Scottish Husbandry, Vol. i, p. 81, note.

in the reservoirs is at that time strongly impregnated with salt, which may be known by its deep brown tinge. Thus the reservoirs, or ponds, appropriated for its reception, may be constantly kept in a state of readiness for that purpose; while the land may be watered or sprinkled as often as the operation may be necessary.

An interesting account of an economical mode of collecting and applying the urine of cattle as a manure to land, has been communicated in No. XLIX of the "Farmer's Magazine," by an intelligent farmer, Mr. Charles Alexander, in the vicinity of Peebles. His farm buildings (for a notice of whose arrangement we are compelled to refer to that useful Work) are so disposed, that the urine of all the stalls is conveyed by trunks to a dung-pit; and the dung is laid in a place appropriated for that use, instead of being thrown into the middle of the yard, according to the usual practice. The dung-pit is twelve yards square, and four feet deep, and is filled with mould previously carted into it, for the purpose of being impregnated with the urine and moisture from the dung. This pit produces about 288 cart-loads, forty of which are sufficient for an acre. The dung itself is laid on the land in the common way; but the compost, made by the urine, &c. with the mould, is spread on the surface after ploughing, and is merely harrowed in. The expense of filling the pit is calculated at about £.6; and 192 loads of dung at 2s. amount to £.28 16s.; so that the advantage of the method is too obvious to be mistaken.

3. Where *greaves*, or the refuse of tallow-chandlers, after making candles, the *clippings* or waste of *curriers* and *fell-mongers clippings*, and *shreds* of *shoemakers* and *furriers*, and the waste or refuse of *glue-makers*, can be obtained in sufficient quantities (and this advantage can only be enjoyed in the vicinity of large towns or cities), they afford an uncommonly useful manure for obtaining *immediate* crops; but their effects are by no means so permanent as those produced by other animal substances, on account of their great attraction of moisture.

4. *Fish*, such as pilchards, herrings, mackarel, muscles, and other shell-fish, afford a useful species of animal manure, to which purpose they are applied in those parts of Britain where such fish are found in abundance. To these may be added, the refuse blubber remaining after the oil is boiled out, the offals of large fish (great quantities of which may be easily procured in

large cities or maritime districts), and the sticklebacks,* a common fish in all rivers and ditches, of which (in some parts of the county of Cambridge) twenty bushels are strewed over an acre of land. The common mode of using these animal substances is by spreading them on the soil alone; hence much of their fertilizing properties is necessarily lost and wasted, which might be preserved (while the offensive effluvia thence arising might be prevented) by a judicious combination: first, of a little effete lime; and afterwards of double or treble the quantity of the whole of good vegetable mould. In Cornwall, pilchards are successfully used, when mixed with sand, soil, or sea-weed: their effects continue for several years.

5. *Unboiled bones*, broken very small, not exceeding the size of small marbles, are likewise an excellent manure, according to Dr. Hunter, upon poor calcareous soils, at the rate of sixty bushels per acre. Bone manure is used to a considerable extent in the west of Yorkshire, in Holderness, and in Lincolnshire, on cold and light sandy soils.† The usual quantity is seventy bushels per acre; but when mixed with ashes, thirty bushels per acre. It is applied in the same way and at the same periods as other manure, and its effects will continue for seven years; they are, however, more evident, especially upon grass lands, and more beneficial the second year than in the first.

6. For chalky lands, the refuse of *horn shavings* are likewise of great advantage as a manure, in the proportion of fourteen or sixteen bushels per acre. When combined with hotter manures, and spread on light gravelly land, they afford a useful corrective of the latter, which they prevent from burning the soil; as horn shavings are found to attract the dew, and to be retentive of moisture.

7. The soiled or damaged *locks of wool*, or trimmings of sheep, and, generally speaking, woollen rags, afford excellent manures; the former are used chiefly in the county of Surrey,

* The *Gasterosteus aculeatus* of the Linnæan system.

† Bones are collected with much care and industry in the fields near Edinburgh, whence they are shipped for Hull. Here, such of them as are not used for knife-handles and button-moulds, are bruised for manure in a mill constructed for the purpose; they are sold at 22 pence per bushel; and the dust which is riddled from them, at 2s. 3d. per bushel, being reckoned of a stronger quality. Farmer's Magazine, No. I.

the latter in Kent, in the proportion of from six to ten hundred weight per acre. Dr. Cullen found them to produce a sensible effect for several years. On account of their possessing a less quantity of oleaginous matters, or of mucilage, they require to be reduced into small pieces in a paper-mill, then strewed upon the ground, and ploughed in about three months before the intended crop is sown.

3. FOSSIL MANURES.

Under this division are comprised various kinds of earth, lime, marl, clay, &c. which vary in their effects, and all of which contribute in a greater or less degree to improve the land, according to the nature of the soils and proportions in which the fossil manures are applied, and the various articles or substances of which they are composed.

1. One of the most useful manures of this class, that has of late years been introduced into rural economy, is *crag*, or the shelly sand deposited in strata, in the neighbourhood of the British coasts. These beds are generally found in crevices and level parts of the shore, though they are often met with at the height of forty or fifty feet above the level of the sea. From the quantity of fine calcareous matter produced by the friction of marine shells, and similar substances, as well as animal matters combined with it, *crag* may be beneficially employed as a manure; especially as it retains a portion of sea-salt, which greatly promotes the decay and putrefaction of vegetable and animal substances. This kind of manure is best calculated for correcting cold, clayey, or loamy soils, on which it will produce most abundant and luxuriant crops: the quantity per acre is from eighteen to twenty tons, though the peculiar nature and other circumstances of soil or situation, as well as the greater or less portion of calcareous matter it contains, will necessarily cause a fluctuation in this respect. But Dr. Anderson has observed, that a considerably less quantity of calcareous matter, when finely attenuated, as in the case of *crag*, will produce more sensible effects, than when applied in the state of earthy marl, being spread more equally upon the land, and more intimately blended with the soil.

2. *Clay*, after it has been burnt, ameliorates wet, cold, and sandy soils, and stiff, cohesive lands: this sort of manure is

chiefly used in the North Riding of the county of York, where the ground is so sandy as to yield, with the application of other manures, only rye; while, with clay, such land produces abundant and luxuriant crops. The quantity per acre varies from ten to twelve loads; and so lasting are the fertilizing qualities of this fossil manure stated to be, as to render a repetition of *claying* for forty-five years unnecessary.

3. *Chalk*. Of this fossil there are two sorts: the one soft and unctuous, which supplies the best manure in its natural state, for lands; the other hard, firm, and dry, which is best adapted to the purpose of burning into lime. Either kind, however, affords an excellent manure for compact clayey soils, into the pores of which it insinuates itself; and by producing a fermentation therein, exposes the clay to the action of the sun, air, rain, and frost, so that its too cohesive particles become loose, and it is reduced to a state of pulverization. But the Kentish chalk does not produce these effects on the clays of that county that are situated near the pits, though it agrees extremely well with other clays; probably, on account of the Kentish clays being of a chalky nature, so that the quality of the manure is nearly of the same nature as the soil. Chalk, however, may be very usefully employed on sandy grounds, the interstices of which it fills up, and thus renders such soil sufficiently compact for the purposes of vegetation, while it totally extirpates the pernicious *Chrysanthemum segetum*, yellow ox-eye, or common marigold, a noxious weed, which peculiarly infests lands of the last-mentioned description.

4. *Coal-ashes*, when properly preserved, are eminently calculated for cold clayey lands, into which, however, they ought not to be too deeply ploughed. They likewise supply an excellent top-dressing for clover, on dry, chalky soils, in the quantity of fifty or sixty bushels per acre, scattered in March or April; and are equally beneficial on grass-lands, on which they are spread either during winter, or in the course of the following spring. The quality of coal-ashes may be much improved, by covering up in every cart-load of ashes one bushel of lime, in its hottest state, for about ten or twelve hours, when the lime will be entirely fallen. The whole is now to be well mixed together, and turned over two or three times, when the cinders, or half-burnt pieces of coal, which would otherwise be of no use, will be reduced to as fine a powder as the lime itself. It

should, however, be remarked, that in order to obtain this benefit from coal-ashes, they ought to be kept perfectly dry; and, when thus prepared, they are stated to improve swampy, moorish soils very materially, and in a very short time.

5. *Leached or soap-boilers' ashes*, are also possessed of eminently fertilizing properties, and are particularly useful for swampy soils, as they effectually destroy rushes and other aquatic weeds. This sort of manure is much used in the United States; where, as appears from a memoir of M. L'Hommedieu (in the "Transactions of the Agricultural Society of New York," Vol. i.), these ashes are found to succeed best on dry loamy lands, or on loam mixed with sand. Ten loads of this manure on poor land, it is stated, will in general produce twenty-five bushels of wheat per acre, which defrays the expense of raising the crop by more than one half. The land is then left in a state for yielding a crop of hay, containing from one and half to two tons of hay per acre, for several successive years.

It is only of late years that the value of this manure has been duly appreciated: and there are few soils on which it may not be beneficially employed. The quantity per acre varies from 100 to 160 bushels, according to the quality of the ashes. The Soapers' waste of London consists wholly of the refuse of kelp and barilla; and when analysed by professor (now Sir Humphrey Davy), yielded 91 parts out of 100 of calcareous matter: consequently it may be advantageously applied wherever calcareous matter is wanted in lands, and will serve the purposes of liming; and the small quantity of alkaline salt and gypsum which it contains, renders it much superior to common calcareous matter, as a top-dressing for every kind of grass. This waste has been found to answer, best of all manures, on a peat moss, in strong cold soils in Surrey, where it was applied in the quantity of two or three cart-loads per acre. In Lancashire it has been found very good and durable on dry pastures, and has also been successfully used in other parts, and in various proportions. It is considered to be, generally, better for pasture than for arable, and crops of clover-hay have been more than doubled by it. The price of soapers' waste, which is particularly calculated for mixing with various composts, varies in different places, according to the demand and the nature of the materials used: thus, in Surrey, it is about 1s. per bushel;

in London, 5s. the cart-load ; in Gloucestershire, 8s. the waggon-load ; and in the county of Suffolk, where the soap-makers are farmers, they will never sell any. The effect of this manure is admirable, both on pasture and arable ; *it destroys slugs and vermin of every description*. The Board of Agriculture (to whose researches and experiments the farmer is indebted for these particulars,) offer it as their opinion, that the farmers in the vicinity of soap-manufactories may avail themselves of these ashes as a manure without the smallest apprehension of loss, and with the fairest prospect of considerable benefit.*

6. *Gypsum, or plaster stone*, as it is sometimes termed, is a native combination of calcareous earth with vitriolic acid ; which, though easily reduced to powder in the fire, is almost as difficult of fusion as lime-stone : it abounds in various parts of England. This fossil has only been introduced into rural economy within a few years ; but its uncommonly fructifying properties render it deservedly an object of notice, as the subsequent facts, drawn from actual experience, will evince.

In the "Letters and Papers of the Bath and West of England Society," Vol. v., there is an interesting communication on the subject of the effects of gypsum as a manure. The correspondent states, that he covered a piece of grass land, to the thickness of two inches, with barn manure ; and scattered pulverized gypsum on another piece of the same land, in order that he might compare the effects produced by each of those articles. The two pieces were mowed twice in the same year, and once in the year following, when the gypsum crop was in every instance the most productive. Exhausted sandy uplands, that had been abandoned, have been restored to a degree of fertility by the use of this fossil, whose effects on cabbages and turnips were equally beneficial : but gypsum appears to be best calculated for chalky and dry calcareous lands. The vegetable crops that appear to be most improved by the use of this manure are, clover, grass, and saintfoin. In order to apply the gypsum with effect, it ought to be previously pulverized, or reduced to small pieces by means of mill-stones, where these can be commanded ; or, which is a more tedious process, by the hand with hammers. When thus reduced, it may be strewed over the land at any

* Communications to the Board of Agriculture, Vol. vi. Part II. See also a valuable little "Essay on the Utility of Soap Ashes as a Manure," 12mo. London, 1812.

period of the year, in the proportion of eight or nine bushels per acre; but the most proper season for this purpose is previously to the falling of gentle showers, as these will materially promote the efficacy of the gypsum. Hence the months of February and March appear to be the most proper seasons for this purpose; and eight bushels per acre are stated by Mr. Kirwan, in his valuable "Treatise on Manures," to be fully sufficient for grass land, as a larger quantity would prove injurious to the soil.

The beneficial effects of gypsum, however, considered as an article of manure, will be more clearly evinced by the annexed experiments, than by any deductions or inferences we could make on this subject; they are selected from Mr. H. Smith's valuable "Essay on Gypsum as a Manure," (in "Communications to the Board of Agriculture," vol. iii. p. 337). Having a field of clover, part of which had not been manured with gypsum, and the produce of which was beyond all comparison inferior to that whereon the gypsum had been spread; he carefully manured two square perches, (in order that he might ascertain the precise value of the hay-crop,) within a foot of the line that separated the part sown with gypsum from the other, weighing the contents of each, and having paid equal attention to the two contrasted perches when cut for seed. The produce of these spots is stated in the annexed experiments.

EXPERIMENT ON RED CLOVER, in 1800.

CLOVER HAY PRODUCT.

	Per perch.		Per acre.			Value at 6s. per cwt.		
	lbs.	qr.	cwt.	qr.	lbs.	l.	s.	d.
A. Gypsum	42	0	60	0	0	18	0	0
b. None	14	0	20	0	0	6	0	0

CLOVER SEED PRODUCT.

	Clover straw per perch.	Clover straw per acre.	Amount at 100. per cwt.	Seed per perch.	Produce per acre.	Value at 15d. per lb.
	lbs. oz.	cwt. qrs. lbs.	l. s. d.	lb. oz.	cwt. qrs. lb.	l. s. d.
A. Gypsum	16 0	22 3 12	1 2 9	0 10 $\frac{1}{2}$	0 3 21	5 5 0
b. None	3 8	5 0 0	0 5 0	0 2	0 0 20	1 0 0

	l.	s.	d.
Amount of hay pro- duct with gypsum	18	0	0
Ditto, without gyp- sum	6	0	0

Extra value by gyp- sum	12	0	0
Deduct expense of gypsum	1	0	0

Clear gain by gyp- sum	11	0	0
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Amount of gypsum, seed value	5	5	0
Ditto, without gyp- sum	1	0	0

Clear gain by gyp- sum	4	5	0
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Total clear gain by gypsum;
viz.

Amount of gypsum, straw value	1	2	9
Ditto, without gyp- sum	0	5	0

	l.	s.	d.
By hay-crop	11	0	0
By seed	4	5	0
By straw	0	17	0

Clear gain by gyp- sum	0	17	9
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Total gain	16	2	9
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Thus there is, says Mr. Smith, 16*l.* 2*s.* 9*d.* clear gain from five bushels of gypsum: he also states that, exclusive of this clover, he had ten acres of lucern, five acres of saintfoin, and three acres of Dutch clover, dressed with five bushels per acre,

which to all appearance received equal benefit. Before we conclude this article, we would add, that Mr. S. conceives five or six bushels per acre to be amply sufficient on very weak and exhausted soils; and as pot-ashes are used in extracting the vitriolic acid from this fossil, he conjectures that some part of the alkaline salt is imparted to the calcareous earth, and that thus we may account for the uncommon effects of gypsum upon chalky soils. But the celebrated practical chemist, Mr. Kirwan, deduces the theory of the effects of gypsum from its uncommon septic properties, though this theory has been questioned by the late Dr. Darwin; because it promotes putrefaction in a higher degree than any other substance. Hence he observes that it ought on no account to be *ploughed in*, but simply scattered or sown on the surface of the land, in order that the old grass may be quickly converted into coal, to nourish the young vegetables.

7. *Lime* is another article in the mineral kingdom which is of extensive utility for manuring lands, both in its native state, and also after it has been burnt. Its effects, however, vary greatly, according to the nature and quality of the substances with which it is combined; for where magnesia is in unison with the calcareous matter (and limestone of this description is found chiefly in the counties of Derby, Northumberland, and Nottingham,) its beneficial effects are by no means so great in fertilizing the soil, and consequently in promoting vegetation, as where such combination does not exist, particularly when the *same* quantities are spread on land.*

On this account, therefore, as well as on account of the siliceous or sandy particles that are sometimes found in union with limestone, it is most advisable to burn it in a kiln; which is effected by depositing therein alternate strata of turf or coals and limestone, and the kiln being carefully closed, the process of calcination will be completed in about *four* hours. Formerly, indeed, a longer time was allowed for this purpose; but the excellence of lime as a manure depending on its re-attraction of fixed air from the atmosphere, and it having been found by experiment, that lime burnt four hours has a much greater disposition to recover such fixed air, than that which has been

* For this valuable and interesting discovery, we are indebted to an ingenious essay, by S. Tennant, Esq. in the "Philosophical Transactions of the Royal Society," for 1799.

twenty-four hours in combustion, the operation of burning should be regulated accordingly.

The process of calcination will, at the same time, afford a certain criterion by which to judge of its goodness. Thus, if its weight be thereby materially reduced, and the lime-shells be extremely light, requiring much water to slack them fully; if a long time elapse before they begin to *fall*; if the limestone be not apt to *run*, or become vitrified during combustion; if it *fall* entirely, when sufficiently moistened with water, after it has been properly calcined; if, in the operation of slaking, it swell greatly; and, if the lime be light, of a fine white, and fine to the touch; in all these instances, Dr. Anderson observes, that the farmer may rest perfectly satisfied of its goodness, and may use it preferably to any other lime, which may be inferior to it in these respects ("Essays on Agriculture," Vol. i). And as lime effervesces with any of the mineral acids, except the sulphuric or vitriolic acid, the facility or difficulty of effervescence, together with a careful inspection of the residuum, will (as the same practical writer has remarked) afford a certain criterion for ascertaining the relative purity or impurity of the different sorts of lime.

Much caution is necessary in the use of native limestone; nor should it, indeed, be ever employed on any soil without duly considering and accurately weighing the nature of the latter. In fact, it will be most advisable to use it in a calcined state in all cases, unless there be a scarcity of fuel for the purpose; and, in such event, it ought to be attenuated as finely as possible, by stamping or bruising to pieces in the best manner of which circumstances will admit.

After the lime has been perfectly calcined, as already intimated, it receives the appellation of quick-lime; and ought to be spread as quickly as possible, immediately before the plough, in order that it may be duly slaked and blended with the soil. This fossil is calculated for almost every soil, but more especially for boggy, peaty, swampy, heathy, and mountainous situations; on waste lands which are over-run with fern, broom, bushes, furze, rushes, &c. and which contain a large portion of coarse vegetable matter, though, from the nature of the plants that cover their soil, they have contracted an acidity unfavourable to vegetation; on rich loams abounding with vegetable matter, the general putrescency of which is promoted by the lime, so

that such soils prove uncommonly fruitful ; on old sheep-walks and commons ; and on low, rich, drained meadows, which have formerly been marshes, and which contain a very considerable quantity of vegetable matter. For the lime, in all these cases, uniting with the soils, corrects them by accelerating putrefaction, and dissolving or removing thence every thing that is noxious or hurtful to vegetation. But on strong, stony lands, or such as are situated upon quarries of lime or other stone ; and on stiff, wet loams, which retain moisture, and are not properly drained, lime produces little benefit.

The quantity of lime to be spread on land necessarily varies according to the influence of local custom ; indeed, numerous intelligent agriculturists have used from one to six, and even seven hundred bushels per acre, on different soils, and with various degrees of advantage resulting from this management. Much, however, must depend upon the goodness of the lime, and the nature of the soil to which it is applied. The general allowance, in the estimation of experienced farmers, should be at least three or four hundred bushels an acre, particularly where lands have for a long time been in a neglected and uncultivated state ; in which case, one good application of lime proves more beneficial than the frequent and repeated scattering of small quantities. Mr. Young thinks that, for common soils, which are not impregnated with acids, or do not abound in putrescible matters, one hundred and sixty bushels will be sufficient for one acre ; which quantity, however, he conceives, should be increased in a double or treble proportion in the case of strong and stiff clays.

As lime, when applied without the addition of any other manure, is said to exhaust the soil, it has been suggested to form small heaps, and cover these with earth ; when the lime is slaked by the moisture of the soil, the piles or heaps are directed to be opened, and as much dung deposited in each as the earth will cover. A better mode of correcting the too caustic properties of lime is proposed by Mr. Andrews, (in the "Annals of Agriculture," Vol. iv.) who directs one hundred and forty loads, each load containing forty bushels, of moist dung to be thrown up into heaps in December, and then to incorporate two hundred bushels of lime. At the end of three months the mass is to be thoroughly stirred ; and at the end of harvest, or, if the season should be unfavourable, after the first

hard frost that occurs, it may be spread on a pea-stubble, and ploughed in for barley, of which it will produce very luxuriant crops. By this method of treatment, the seeds of weeds usually found in dung will be effectually destroyed, while the increased fermentation, thereby produced, more speedily excites the fertilizing qualities of the dung.

The expense of liming necessarily depends upon the expense of fuel for burning, and the distance of carriage, so that we cannot specify any criterion on this point. We shall therefore observe, in addition to the facts already stated, that lime destroys snails, slugs, and other insects, which abound on almost every soil; and though, as already intimated, it may not be proper for clayey lands, yet it was the opinion of the late Dr. Darwin, that if they were properly mixed with such soils, they would become less cohesive, and consequently be more easily penetrated by vegetable fibres. Lastly, as lime is an excellent corrector of acidity, it is peculiarly calculated for those grass lands, the produce of which is so rank and sour as to be refused by cattle; so that if a handful of lime, for instance, be thrown upon a tussock, or spot of long rank grass, that has been rejected *for years*, cattle will afterwards eat it close to the ground.

The phosphoric acid and lime, one proportion of each, when combined together, form *phosphate of lime*: it forms the greatest part of calcined bones; exists in most excrementitious substances; and is found both in the straw and grain of wheat, barley, oats, and rye, and likewise in peas, beans, and tares. It is rarely found in a native state, and then only in small quantities. Phosphate of lime is generally conveyed to the land, in the composition of other manure, and it is probably necessary to corn crops, and other white crops.*

8. *Marl* is calcareous earth, found in different parts of this island, in various forms, and blended with various substances; according to which it is differently called stone-marl, argillaceous or clay marl, and shell marl. The first is so denominated from its being of a harder consistence than the other sorts, on account of the greater or less quantity of sandy particles it contains; of the second kind clay is a principal ingredient; it is of a grey brown, or reddish brown tinge, sometimes intermixed with blue and yellow. In shell marl, the chief

* Sir H. Davy's Lectures, p. 336.

component is a decomposition of shells, effected in a long course of years, blended with a small portion of earthy matter. The strata, or beds, where this mineral is found, are from two to twelve feet thick, and at various depths below the soil. But all these varieties of *genuine* marl agree in effervescing with acids, (the best test for examining them), falling in water, crackling in fire like salt, and becoming pulverized on exposure to the atmosphere.

The best season for applying this fossil manure on lands is in the months of January and February : the quantity varies according to the nature of the soil. For sandy light lands, the argillaceous marl is preferable, as the stone and shell marl is best calculated for stiff, clayey, and loamy soils. The average allowance for sandy ground, Mr. Young states to be about fifty or sixty cubical yards per acre ; but on loose, wet loams, (which are greatly benefited by the use of marl), it should be spread to the quantity of 100 yards. Much attention, however, is requisite in this respect ; as, if too large a proportion be spread at one time, there will be a difficulty in removing it ; whereas, if too little appear to have been spread, the deficiency may be easily remedied by resorting to frequent light dressings.

On account of the expense attendant on marling land, this mode of manuring is best calculated for inclosed lands, which it has been recommended to lay down with clover, rye-grass, and trefoil, in the spring, twelve months before the application of the marl, and to remain at least six months after it ; that it may have time to sink and eat itself into the *flag*, before it be ploughed up, when there will be little or no danger in losing it, being already in some measure incorporated with the soil. Every attention should also be given to break all the lumps, and get it fine by repeated harrowings and rollings, and having all the stones picked and carried away, in order that the grass may shoot up as soon as possible, that stock may be grazing upon it. So permanent are the fertilizing properties of marl, that if it be properly spread on land, it will continue arable for twelve or fourteen years, and for pasture during a much longer term.

A most successful instance of the beneficial effects resulting from the judicious application of marl, occurs in the "Communications to the Board of Agriculture," Vol. ii. Our limits forbidding a detail of the whole process, we shall at present only state, that thirty years since Mr. Rodwell (whom the Board

honoured with their gold-medal) took a farm of 1400 acres, chiefly poor heath land; during that period he has broken up and manured the land with nearly *one hundred and forty thousand* large tumbril loads of clay and marl, at the expense of *four thousand nine hundred and fifty-eight pounds*; his indefatigable exertions have been crowned with great success, so that the annual rental of his farm has been increased from *one hundred and fifty to seven hundred pounds*.

Where no marl-pits exist, or this fossil cannot be procured but at an expense by no means commensurate with the benefits that would be derived from it, a good artificial marl may, it is said, be formed by mixing equal parts of lime and pure clay in alternate strata, so as to form a heap, which is to be exposed to the winter frosts. This compost is asserted to be calculated for light lands, and little inferior to the genuine marl; but for strong and heavy soils it will be necessary to mix loam and sand with the lime, in lieu of clay.

9. *Salt* is another fossil manure, of singular utility to pasture lands; on which, when it is properly scattered, cattle thrive very speedily. It is also said to be of great use for raising turnips: besides which, it not only improves and increases the herbage, but also sweetens sour pastures, while it destroys weeds and noxious vermin. The most accurate proportion is stated to be sixteen bushels per acre; for if that quantity be exceeded, its beneficial effects will be diminished, and vegetation be completely checked: but the general knowledge of this manure is at present in its infancy, for want of more trials being satisfactorily made. In New England, North America, salt has been very beneficially applied as a manure for flax, in the proportion of five bushels per acre, in which it had an extraordinary effect.*

* Sir J. Sinclair on Scottish Husbandry, Vol. ii., Appendix, p. 183. Sir H. Davy thinks it not unlikely, that the same causes influence the effects of salt as those which act in modifying the operation of gypsum. Most lands, in this island, particularly those near the sea, probably contain a sufficient quantity of salt for all the purposes of vegetation; and in such cases the supply of it to the soil will not only be useless, but may be injurious. In great storms, the spray of the sea has been carried more than 50 miles from the shore; so that, from this source, salt must be often applied to the soil. He has found it in all the sand-stone rocks which he has examined, and says, that it must exist in the soil derived from these rocks. It is a constituent, likewise, of almost every kind of animal and vegetable manure. Lectures, p. 339.

10. *Sand* is reputed to be an excellent manure for moorish or swampy lands, in the proportion of 160 loads per acre; and for clayey soils, in the quantity of forty or fifty loads. *Sea-sand* (the farther it is brought from the high-water mark the better) is the best calculated for this purpose; and next, in point of quality, is the sand washed down by heavy showers on gravelly soils: the other light dry sands, being liable to be drifted about by every breeze of wind, are of no use whatever. Sand was formerly used to a considerable extent in the southern parts of Devonshire and the West of England; but it has been gradually relinquished, and will probably be soon entirely superseded by LIME.

11. *Soot* from coals is preferable to that obtained from the burning of wood: it is a very powerful manure, and answers best on light, dry, chalky soils, and in moderately wet seasons; but produces little benefit on strong, wet, clayey lands, or in very dry seasons, unless it be sown earlier than usual. It succeeds well, when sown on peas and clover, in April; and if thinly distributed on newly-sown turnips just before they come up, it not only destroys insects, but is said to secure them effectually from being affected or injured by the fly or grub; provided no rain falls to wash the soot into the soil. The quantity per acre varies from twenty to forty Winchester bushels; but, where no other manure is used, thirty bushels are reckoned a complete dressing. The expense is from 1*l.* 10*s.* to 1*l.* 16*s.* per acre, including the cost of the soot, the carriage of it from the metropolis, and the labour of sowing, which is done in the same manner as seed-corn is committed to the ground.

IV. FLUID MANURES

comprise water, mud, urine,† and, generally speaking, all liquid matters, which are, or may be, profitably converted to the manuring of land.

The best methods of employing water for this purpose have been stated in a former part of this chapter,* as well as the advantages resulting from *warping* land.† Here, however, we would observe, that *flax* and *hemp water* promises to be a useful fluid manure. "In Yorkshire they observe, that the grass grows doubly where flax is grassed, which shows that all

* Ante, p. 318 and following.

† P. 341—345.

‡ On the Application of Urine, see p. 361.

the putrid water of the pits should be used as manure.—Mr. Billingsley carted flax water on his land, and the effect was extraordinarily great. These very valuable hints," Mr. Young (Bath Papers, Vol. x.) remarks, "should be pursued. And, wherever convenient ponds or reservoirs are on a farm, one at least should be half filled in summer with green weeds for the putrid water, which would soon be the result."

With regard to *mud* (which term includes the sweepings of streets and roads) rendered fluid by rains, particularly the miry sediment found at the bottom of ponds; it is improbable, as Mr. Young has justly remarked, that *pond-mud*, especially if there be a stream running into the water, should ever fail of proving a good manure, when used with judgment. The mode of using it, which has been found most advantageous, is as follows:

As soon as the mud is dry, and sufficiently hard to split, it should be turned over; and, at the end of three or four weeks afterwards, an equal quantity of chalk or marl is to be mixed with it; the chalk being either carried to the mud, or the reverse, as convenience or other circumstances may require. If lime can be had at a cheap rate and in abundance, the addition of one-fourth part of lime to the mud will prove of great benefit. The whole must be well incorporated, and continue from June (the usual season for this work) until September, when it should be again turned over, and spread upon pasture or meadow land in October.*

The best mud for agricultural purposes is that taken from ponds which have received the draining of farm-yards; to which may be added the scourings of old ditches, which chiefly consist of decayed vegetable matter, and the sweepings of London streets; both of these, however, require to be mixed with horse-dung, in order to promote fermentation, before it be spread upon the land. Thus prepared, mud forms an excellent top-dressing for grass-lands; but it ought on no account to be spread in too great quantities, or too thickly at one time; otherwise it will retard the growth of grass, and consequently prove detrimental, rather than of service, to the ensuing crop. Ten or twelve loads per acre are said to have been carted on lands with the most beneficial effects.

* Farmer's Calendar, p. 671.

V. COMPOUND MANURES.

A few years only have elapsed since manures, combined from different materials or substances, have been known to the agricultural world, under the names of *composts*. Of their utility no doubt can exist, since it has been proved, by actual experience, that the mixture of such matters as are calculated mutually to act upon each other, and are adapted to the different states of land, are eminently useful in increasing its fertility, as well as accelerating the growth of vegetables.

The best composts are those which are made from a mixture of animal substances with earth. Formerly it was the practice to make composts in *layers*, by which means much of the strength of the manure was necessarily wasted, before it could be spread on the land; it is, however, a more economical method, first to mark out the spot or yard, next to cover its *concave* bottom four or five inches deep with very tough clay, and then to cover this stratum with strong gravel, well beaten in, to prevent its removal when the manure is taken out. Into this spot should be conveyed a quantity of earth, taken either from the top or under surface, and of a quality adapted to the land to be manured; that is, for compact, stiff, clayey soils, *sand*; and for open, porous, sandy ground, *clay*: it will also be necessary to cut down and collect all the weeds about the farm, before they seed (to which may be added the deciduous leaves of trees), into the yard, where the putrefactive process may be completed by the aid of lime, in the manner already mentioned in p. 355 *supra*. After thoroughly breaking the several materials, (such as saw-dust, offal, bones, waste, or refuse fodder, the refuse of blubber, after extracting train-oil, and in the cyder counties the refuse of apples and pears after making cyder and perry), they may be laid in heaps around the space marked out for the compost heap, a man being placed between each two heaps, to throw the manure spreading upon the space. Thus the compost heap will be shortly raised to the requisite height; and, the various ingredients being thoroughly mixed, the whole will ferment, and in the course of two months will incorporate as fully as the same manures disposed in layers in the common method. It is to be observed, that though autumn is above

stated as a proper season for making composts, on account of the weeds and leaves, yet this business may be carried on at other times in the year; but composts, thus prepared, ought not to be prepared too long before they are spread upon the land, as they will waste considerably, and the most fertilizing particles be evaporated.*

For composts thus made, one faithful mixing or turning will be fully sufficient; for, as an intelligent American agriculturist (Mr. Bordley) has justly remarked, the frequent turning of composts will weaken them as a manure, by checking the fermentation of the mass. Should, however, such fermentation subside too early, holes may be made in the heaps, from the top nearly to the bottom, with a pole, into which may be thrown urine, or farm-yard liquor; and as the water drains from the heaps, it should be carefully collected and thrown upon them. As it must frequently happen, that this part of the business cannot be done precisely at the time when the water has so drained off, from the farmer being necessarily occupied in attending other matters, wooden troughs, or gutters, well paved with gravel well pounded, or with lime and gravel mixed with boiling hot lime-wash, and spread with a trowel, may be advantageously made, for the purpose of conveying the liquor to a tight barrel, or hogshead, in the ground, whence it may be thrown upon the heap at a leisure time; and consequently the fertilizing liquor will be prevented from losing its properties by evaporation.

Such a compost, it is observed, may be made to suit any kind of soil, by duly apportioning the ingredients; and is peculiarly excellent for meadow or pasture grounds. But where these lie at a considerable distance, or the earth intended to be mixed with the compost must be brought from a considerable distance, much time and expense of carriage may be saved, by making a compost heap on the headlands of the fields intended to be manured. The best situation for this purpose is upon level ground; or, if it be unavoidably upon a descent, a trench should be cut on the lower side to receive the oozing, or running, from the heap, which may be occasionally thrown upon it in the manner already mentioned. The proportion of compost allowed to each acre may be calculated at from sixteen to

* Farmer's Calendar, p. 92.

nineteen or twenty loads, each load containing from one ton and a half to eighteen hundred weight; though the nature of the soil, and other circumstances, may require either a smaller or a larger quantity.

VI. PRESERVATION OF MANURES.

As manures are of such indispensable necessity to the farmer, and dung is in general so important a manure, every possible method should be taken, not only to prevent it from being wasted, but also to improve it both in quality and in quantity. In no way are manures more wasted, than by too great exposure to the sun, air, and rains; hence various expedients have been resorted to, in order to prevent this loss. Such, for instance, are the mixing of dry earth, or other absorbent substances, which certainly will, in a great measure, prevent this inconvenience; the erection of slight sheds over dung-heaps with the same intention; the covering of these heaps with turf sods (the *grassy side* being *downwards*), when the dung is to be kept till it be old; are by no means bad practices, as the turfs will, in the course of time, be converted into excellent manure.

The farm-yard is doubtless the most proper and convenient place for forming *dung-steads*, or *dung-meers*, as the repositories for this useful article are variously termed. For middle-sized farms one will suffice: for larger farms two or more will be necessary, for the proper management of dung. According to the usual practice, a pit is dug sufficiently deep to hold the soil which the farm may require; and into this are thrown waste fodder, fern, straw, leaves, coarse grasses, thistles, rushes, flags, and similar aquatic plants; litter, scrapings of the yard after rain, sweepings of the kitchen, bones, ashes, shells, wool-len rags, weeds, &c. which lie there and rot, until they are wanted for use. It has, however, been suggested by the late Dr. Darwin, to dispose the heap of dung on a gently-rising eminence, with a basin beneath, for collecting the superfluous water that may ooze from the heap. We would add, that if a shady spot cannot be obtained for this purpose, a slight shed should be thrown over the dung-stead, to prevent too much exposure to the sun, air, and rain; and that gutters should be so contrived, that all the waste water and urine of the yard,

oil dregs, greasy water, bloody water in which meat or fish has been washed, old useless brine, the suds and waste water of the farm-house—in short, every possible kind of liquor that may be useful—may flow through them into the reservoir, or basin, and be preserved. Dr. D. further states (in his "*Phytologia*"), that some earth, weeds, saw-dust, offals, or other vegetable or animal excrement, should be thrown into such reservoir; which will, in consequence, promote the fermentation and putrefaction of the substances therein contained, at the same time that the draining from the dung-heap will not be dissipated.

The necessary dépôts for manure being thus prepared, it will only remain for the farmer to avail himself of every possible matter, both of the vegetable and animal kingdom, for increasing and improving its quantity and quality. In addition to the various articles enumerated in the preceding paragraphs, we would observe, that before the winter or foddering season commences, the surface of the cattle-yard may be raised by spreading thereon dry swamp-mud, pond-mud, the dry scrapings of roads or ditches, and similar matters that can be procured. On this stratum may be spread a little lime, for the more speedily accelerating the decomposition of the litter, fern, and other tough vegetables that may be thrown upon it for that purpose; and, in case the season should prove too dry, the decay of the vegetable matters may be promoted by sprinkling them occasionally with water from the pump, or (which is preferable) with some of the liquor from the reservoirs at the bottom of the dung-steads. Every previous arrangement being thus made, the cattle ought to be kept within their yards throughout the winter season: where they are numerous, the surface of the yards may be removed to the dung-meers, and laid down afresh in the manner above mentioned.

With regard to the increasing the quantity of manures, agriculturists are by no means agreed as to the point of allowing litter for their beasts to lie on, or of consuming their whole stock of hay and straw, and placing the floors in such a direction, that they may be kept clean by sweeping only, so as to render litter of any sort unnecessary. The latter practice was adopted by the late eminent breeder, Mr. Bakewell, is sanctioned by many eminent farmers, and, it is obvious, must produce the largest quantity of animal manure, from the straw and coarse food being consumed by lean beasts, while the richer and more

succulent is eaten by the fatting beasts, whether neat cattle, sheep, or lambs. Both practices, however, may perhaps be united with advantage, where the surface of the yard can be raised in the manner above mentioned.

The augmentation of manure necessarily increases in proportion to the nature of their food. In Chap. III. pp. 132—152 of this work, we have pointed out the various articles of the vegetable kingdom that are best calculated for feeding and fattening cattle; and, we trust, have fully evinced the superiority of *soiling*, both as it respects the economical consumption of food, and also the production of manure. The quantity of manure, afforded by a farm, may likewise be materially increased by having *standing sheep-folds* (*ante*, p. 168), and especially by adopting the Flemish practice of keeping them beneath covered folds. For this purpose, in Flanders, the ground is marked out, and spread with dry sand, four or five inches thick; on this are erected slight sheds, in which the sheep are housed at night, a small quantity of fresh sand (for which dry peat, or any of the earthy materials above stated, may be substituted) being laid on every evening. This is cleared out once a week, and carried to a dung-hill or spread upon the soil. The manure thus produced is admirably calculated, in the opinion of M. Quintinie, for fertilizing almost every kind of ground, and in fact makes an excellent dressing for cold and stiff soils.

The most effectual method of raising a supply of manure for land, (especially in counties that are situated at a distance from the metropolis, so that they cannot be thence supplied with dung, &c.), in Mr. Middleton's opinion ("Transactions of the Society for the Encouragement of Arts, &c." Vol. xvii), consists in raising green crops for the purpose of feeding sheep, bullocks, or other animals on the land. "For," says he, "this is the only method by which the loss of nearly all their urine and dung, that unavoidably occurs under other systems of management, can be prevented; as there is a great waste, perhaps of half (including dung and urine), in the stables, cow-sheds, fold-yards, and dung-hills, even under the best management. Under ordinary management, three parts of this manure are lost; but in the *soiling* of tares, turnips, cole, clover, &c. in the fields, there is no loss: the whole is immediately applied, without the cost of carriage, to the enriching of the soil."—It is obvious, however, that much of the ameliorat-

ing properties of these manures must necessarily be lost by evaporation, and otherwise be materially diminished ; so that although (as in the county of Norfolk) the soiling of sheep with turnips may be carried on with great advantage on light lands ; yet, upon the fullest view we can give the subject, we are decidedly convinced that, under proper management, stall-feeding in summer with green, and in winter with dry food, is the most effectual mode of obtaining the largest possible quantity of animal manure.

In a former part of this chapter (p. 360), the effects of human ordure, as a manure, have been stated ; and as, according to the present method of managing it, much valuable fertilizing matter is inevitably lost, it has been suggested (" Communications to the Board of Agriculture," Vol. i.) to form reservoirs, or pits, with floors of clay, or other material, impervious to liquid matter, as nearly as possible to the dung-heaps, and to connect such reservoirs to the privies by means of proper drains, furnishing them with covers, for the purpose of throwing in occasionally lime, peat, vegetable recrements, and other substances, that might be removed thence when they should be thoroughly impregnated and reduced to putrefaction, and be mixed with the common dung-heaps. In large towns and cities, where immense quantities of this kind of manure are annually produced, it is recommended to construct such reservoirs or basins with similar floors and drains, but upon a larger scale, so that their contents may be removed as often as necessary, during the night. Or, where large rivers flow through cities or towns, &c. reservoirs of this description might be formed on their banks, and the ordure be thence conveyed into covered boats or barges ; or this manure might probably be conducted, through the medium of sluices, from the extremities of the common sewers into such barges, and be easily transported to distant places. And, as the system of canal navigation is now brought to so high a degree of perfection, the expense of carriage will be trifling indeed.

Dung-steads may be tended, and the respective manure augmented at different times, when no other business of greater moment stands in the way ; and to prevent the heaps from being too much torn or spread about by the scratching of poultry, or by swine, they should be surrounded by pens, made of broad deals. In wet seasons it will be advisable to throw a

slight shed over the dung-steeds; and, as the heaps will not ferment so expeditiously as could be wished, it may be useful to turn them over once or twice in the course of the summer; thus they will become more thoroughly mixed and mellowed, and rendered sooner fit for use, while the seeds of weeds therein contained will vegetate and be destroyed.

The following method of making dung-hills, as practised in Middlesex, we give from Mr. Middleton's interesting Agricultural Survey of that county; and, from its judicious arrangement, it has a just claim to the attention of agriculturists.—In the first place, all the scrapings of roads, mud of ditches and ponds, and the top mould of gravel-pits, are spread in the most convenient spots, as bottoms for dung-hills; on these layers is carted all the dung produced on the farm, together with the whole of what can be obtained from London, and the various inns on the road: to which materials are occasionally added chalk, ashes, soap-boilers' waste, bricklayers' rubbish, &c. In this state the mass or heap continues till within one month of the time for manuring land; the whole is then turned and thoroughly mixed together, the larger clods being broken into small pieces, and the drier parts being thrown into the middle. In consequence of this management, the mass becomes more intimately blended, and the putrefactive process is completely finished, while the matters remain in a heap. At the same time, by this method of forming the bases of dung-hills, the fertilizing liquor which distils during the fermentation and heat that necessarily ensue, is effectually preserved, and greatly contributes to ameliorate the soil.

VII: ON THE APPLICATION OF MANURES.

As manure is essentially necessary to the improvement of land, and to promote the growth of plants; while its fermentation and warmth dispose the soil for the more easy admission of moisture from the atmosphere, and thus ultimately contribute to the support of human existence; the mode of applying it to the greatest advantage is a subject every way deserving of attention. In the preceding discussion of the various articles capable of being employed for this purpose, some hints as to their general application have necessarily occurred; but, beside these, there are other circumstances to be regarded, viz.

the crop—whether tillage or grass—the nature of the land whereon the manure is to be spread, and the state of such manure at the time it is to be employed; on these points we now proceed to state some remarks derived from the experience of the most intelligent agriculturists.

With regard to the *state* in which manures are to be spread on the land, it appears, that those soils which are intended for the production of crops that speedily attain their full growth, derive the greatest benefit from the application of such manures as are thoroughly reduced by the completion of the putrefactive process; of this description are grass-lands and meadows. On the contrary, where vegetable crops are longer, both in point of duration and also before they arrive at maturity, those sorts of dung, or manure, which have undergone the least change or decomposition, are most beneficial: to this class belong tillage-lands in general, especially stiff clayey soils. And hence it has been found, that the turning in of green crops for this purpose is a very beneficial practice. Lord Kaimes,* indeed, disapproves of ploughing down buck-wheat, clover, or any other crop for manure; and conceives the best way of converting a crop into manure, to be by passing it through the body of an animal, as the dung and urine (to omit the profit of feeding) will enrich the ground more than ploughing in the crop. This opinion is supported by many respectable agriculturists; while others, equally intelligent and equally respectable, have urged the benefit resulting from this practice. Such a difference of opinion can only be accounted for by the difference of soil, situation, and circumstances under which they must of necessity have been. But as we have already stated (p. 357), the best time for this purpose, we shall at present remark, that all vegetable crops intended to be employed as a manure ought to be carefully turned in with a skim-coulter plough, in order that it may be thoroughly concealed from the eye.

In regard to the time or season for manuring land, whether it be spread simply upon the surface, or ploughed down into the soil, it is difficult to state the precise period; because the peculiar convenience of the agriculturist, together with the condition of the land, must always influence his practice. In

* Gentleman Farmer, p. 258.

general, however, the following points will afford a criterion by which to regulate the application of manure:

I. The land should be dry, in order that it may be fit for the reception and retention of the unctuous parts of the manure; although this circumstance may admit of a slight variation. Thus, in the case of grass or meadow-lands, which require the manure only to be strewed or spread on the surface of the soil, it will be best to apply it a short time before the grass, &c. shoots upwards from the ground. On the contrary, where it is deposited in the earth, the most proper time will be immediately before sowing the seeds for whose nutriment the manure is destined to serve; because, as Dr. Darwin excellently remarks; the atmospheric air that is buried with the dung, in consequence of its union with the carbon in the cavities or interstices of the earth, gradually evolves a genial warmth, which greatly accelerates vegetation.

II. The manure ought to be spread without delay, (in fact as soon as may be practicable after it has been carried to the field), and dispersed as equally as possible. For this purpose, the labourers and implements should be ready on the spot. Mr. Bordley directs the loads to be regularly arranged in *lengths*, or rows, and the dung or compost to be immediately turned in, "*line by line*;" as it more readily dissolves in the ground when newly covered, and its whole strength is thus secured to the soil.

III. Further, the manure should be speedily mixed with the earth, and buried at a proper depth, lest the oily and nutritious particles should evolve and be dissipated. On the coarser soils, therefore, from three to four inches would be a sufficient depth; though the manure may be set much deeper in the more porous and friable sorts of land.

From these remarks then it appears, that autumn is in general the fittest season for depositing manure, the earth being then sufficiently dry for the purpose; though the farmer may, in many cases, as above intimated, successfully deviate from the regular practice. In order, however, to prevent an undue evaporation from taking place in hot weather, some caution

should be observed, that the strength of dung be not diminished by carting out more from the dung-stead than can be properly dispersed shortly afterwards, or by shovelling it more than is absolutely necessary, in hot, windy, or dry seasons. On the contrary, if this business be performed in calm, serene, or in cloudy weather, the volatile parts of the manure will not evaporate in any considerable degree. Further, when the farmer has carted away his dung-heaps from his yards, he should take up an inch or two of the surface ground beneath, unless it be rendered impenetrable to moisture; because, ordinarily, much of the strength of the dung and urine has passed into it, and made it a good manure.

IV. The manure ought to be invariably proportioned to the nature of the soil; because if too much dung be laid on a warm and light soil, it imparts to the latter a still greater degree of heat, which in a measure burns up vegetables; and, on strong soils, too large a quantity will make the plants shoot up with too much luxuriance, in which case they rarely attain to perfect maturity.

In the former part of this section, the various natures of the different sorts of manures, together with the soils to which they were peculiarly applicable, have been stated, so that little perhaps can be said in addition on this head. In order, however, that manures may be duly proportioned to the soil, it may not be useless briefly to recapitulate:

1. That the wetter, and consequently the colder, lands are, the more dung they require; because their cold nature should be corrected by the warmth of the dung.
2. On the contrary, a less proportion of dung will be sufficient for drier soils, lest the too great heat should burn up the plants.
3. For cold, stiff, loamy clays, which are liable to become too solid and impenetrable to the fibres of vegetables, the manure ought to be employed before it be perfectly decomposed, as it will thus prevent the surface from becoming too solid and firm; and notwithstanding, as Dr. Darwin has remarked, the putrefaction will in some degree be retarded, yet the fertilizing substances will, at length, totally

decay, and afford to the roots an equal, though more gradual supply of nutriment.

4. Vegetable earth or mould being, in general, of a drier nature than the preceding sort of soil, does not require so large a quantity of dung.
5. Sandy lands being naturally hot, and superficially covered with a still hotter layer or stratum, require dung that is perfectly decomposed and putrefied, though indeed, manures in an imperfect state of decomposition may be applied; they should, however, be laid on in smaller quantities at one time, and oftener. And as such soils are, in some districts, greatly improved by *folding*, the dung thus applied should be mixed with the soil by the plough or harrow, or with the hoe or shovel, every two or three days, if the weather be dry; in cloudy or rainy weather, it will not require to be so frequently mixed. By pursuing this method, much will be saved; and half the time that fields are commonly folded will, probably, be sufficient to enable them to yield a good crop.

With regard to the manures which are spread on the surface of grass-lands as top-dressings, the proper season for laying on the coal-ashes, soot, lime, wood-ashes, malt-dust, &c. usually employed for this purpose is, as early in the spring (in February) as may be conveniently practicable; for, in general, those articles are spread in too small proportions to require a whole winter's rains to wash them into the soil; whereas, by dispersing them over the soil in a state of coarse powder, or in small lumps that cohere but slightly, the vernal showers will wash them into the soil, so that the stems of young grass may easily shoot upward through the ground. But, where a second harvest of hay is to be made, and the weather is not too hot, another top-dressing of perfectly-reduced manure may be applied, with considerable benefit to the crop.

Grass-lands may be much ameliorated, both in the improvement of the herbage, and also in the amount of the produce, by cutting them five or six inches deep with a five-coulter cutting-plough, or scarificator, that cuts the surface in slips four or five inches asunder, but without raising or turning them. It is the sinking of the manure into these incisions, which effects the improvement just mentioned; and which ad-

vantage is greater than if the manure were first applied, and the cutting then took place; and both are, in the opinion of Mr. Young, superior to the practice of manuring without cutting, as has been abundantly proved by experiments. It may, however, be remarked, that this system of cutting, though applicable with equal success and benefit to clayey grounds, loams, and gravels, is not capable of being employed with effect upon very strong grounds, abounding with stones, as the coulters are liable to be thrown out of work by the stones and similar obstructions.

After the grass is mown, some farmers give the land a dressing of dung, usually in September: but this operation ought not to be deferred beyond October. Where composts are used, the end of September Mr. Y. thinks, to be the best season for using them; the proper quantity is about fifteen or twenty cubic yards per acre, every fourth year, unless the pastures be very rich; a pound of common salt being always mixed with each cubic yard of compost in turning over.

In a preceding page, the practice of ploughing in manures a short time before the grasses begin to shoot, or the seeds of other vegetables are deposited in the ground, has been mentioned as conducing to promote their respective growth. There is, however, another advantage resulting from this mode of manuring land, viz. that, as the whole is thus made to nourish the vegetables in an immediate and direct manner, a *smaller quantity* will be fully adequate for this purpose. Further, as the collecting, preserving, and augmenting of manures is necessarily attended with considerable expense, it certainly behoves every intelligent agriculturist to employ it in the most economical way. This object is stated to be, in a very great measure, attainable by adopting the drill husbandry, one principal advantage of which consists in depositing the manure in *drills*. Mr. Parkinson ("Experienced Farmer," Vol. i. p. 32,) observes that such drills should be made two feet asunder, each being six inches wide at the bottom; thus he sows peas, beans, &c.; from the result of which he asserts, that in consequence of the manure being thus kept closely together, and the seeds being placed immediately upon it, four loads will perform, in the drill husbandry, as fully and as beneficially what would have required *sixteen* loads in the usual way of spreading it over the land.

Having thus, we trust, amply and perspicuously described the various important circumstances connected with the collecting, preserving, and application of the manures, we shall conclude this branch of our subject with the Rev. Mr. Close's very valuable table for manuring land, which will enable the farmer at one inspection to calculate, with accuracy, the number of loads which it will be necessary to employ in manuring a field, per acre, at the distances therein specified.

Number of heaps to a load . .	Number of loads per acre.							
	1	2	3	4	5	6	7	8
At five yards distance	193	96	64	48	38	32	27	24
At five yards and a half distance . .	160	80	53	40	32	26	23	20
At six yards distance	134	67	44	33	26	22	19	16
At six yards and a half distance . .	114	57	38	28	22	19	16	14
At seven yards distance	98	49	32	24	19	16	14	12
At seven yards and a half distance .	86	43	28	21	17	14	12	10
At eight yards distance	75	37	25	18	15	12	10	9

Explanation of the first two rows of Figures in the preceding Table.

The number of heaps consisting of one load each, laid at five yards distant, is 193 to cover one acre; at *two* heaps to a load 96; at *three* heaps, 64; at *four*, 48; and so to the end:—each of the following rows is to be read in a similar manner.

SECTION IV.

INCLOSING OF LAND—SIZE AND SHAPE OF FIELDS.

IN the article of expenditure on a farm, the items for fences usually form a very prominent feature. There is no doubt but that much unnecessary expense is incurred by dividing the fields into too small inclosures. The size of fields is in many instances regulated by the terms of the lease: but, if the farmer were sometimes to sacrifice a little taste or ornament to the judicious classification of fields, according to the soils they respectively contain, his profit would be much greater. The extent of fields must further be regulated by the size of a farm, and the uses to which they are to be converted.

Such inclosures as are chiefly designed for the production of

grass, ought to be smaller than those in which grain crops are intended to be raised. On light, sandy, or gravelly soils, the divisions should be small in proportion to their dryness and to the particular crops, which can most advantageously and most commonly be grown upon them. Inclosures on sheep downs and other lands where there is considerable elevation, should probably have a reduction of their extent proportioned to their height, and the dryness of the grounds, the thickness of the hedges being likewise regulated by the same circumstances.

"Where the divisions are large," it has been ably remarked,* "and the soil moist, great care must be taken in making proper drains to supply the want of ditches, which answer the same purpose when properly formed. The frequency of full-grown hedges, high ditch-banks, and trees, on the first sort of ground, has considerable effect in preventing such lands from becoming too dry for the successful growth of different crops. It is stated by a judicious writer, that 'equal care should be taken to guard against the extremes of too much exposure, and that of creating a thick damp atmosphere, as the health, thrift, and beauty of animals are greatly promoted by proper shelter and a due circulation of air. For instance,' continues he, 'a low, flat, and naturally damp situation, divided into small inclosures by high hedges and broad shaws, especially if they abound with trees, is totally unfit for the production of corn crops, and still more if it be exposed to a northern aspect, and inclosed with wood. In that case the sun is too much excluded, and the damp cannot be sufficiently drained and evaporated to prevent the redundancy of moisture from chilling the better plants, leaving an herbage that will be of no value to a farmer. On the contrary, if it be free from adjoining woods, be drained, and the ditches kept well cleansed, it would make good permanent pasture or meadow. If, in addition to these, the hedges should be kept closely cut or clipped, the fields large, the trees trimmed to the height of twelve or fifteen feet, and every possible method taken to promote the free admission of the sun's rays, with a perfect drainage and evaporation, it would be fit for many of the purposes of aration.'"

"But though the stagnation of the air in confined situations"

* By Dr. Dickson, to whose elaborate work on "Practical Agriculture" we are indebted for most of the following strictures on the size of fields.

may have an injurious effect on vegetable as well as animal life, by preventing the proper degree of evaporation from taking place; it is not less injurious to the feeding of animals than the growth of vegetables, when it circulates too much or too rapidly over a district, especially where the elevation is considerable, as in mountainous and hilly situations; for in such cases the warmth of the animals is too suddenly carried off by the too frequently renewed application of cold air, and the growth of the vegetable thereby much checked and retarded. In such situations, therefore, particular attention ought to be paid in planting the hedges so as best to break off the winds they would be the most exposed to. 'It is as well,' says the writer we have just quoted, 'for the purpose of shelter, shade, and equable warmth, as of occasional fresh supplies of grass, that the Leicestershire graziers have founded their opinion, of fifty acres in five inclosures being equal to sixty in one.'

"It would seem, therefore, that whether land that is to be inclosed be intended for the purposes of pasturing, or the production of grain, root, and such-like crops, it will be the most advantageous to avoid the extremes of very large or very small inclosures; but that in the latter cases they may be left more large and open than in the former. From seven or eight to fifteen or even twenty acres, according to the extensiveness of the farm, for such sorts of land as are chiefly to be employed in the way of grazing, may, in general, be the most proper; and from eight or ten to thirty, in proportion to the magnitude of the farm, in common, may be the most suitable for those of the arable kind. But whatever be the dimensions adopted for the inclosures, great attention should constantly be had to the convenience of water, the position of the ground, the purposes of drainage, and the bringing together, as much as is easily practicable, lands of a similar quality, or such as can be cultivated and sown under the same circumstances, though it may tend to render them unequal in regard to size, and irregular in form.* Where, indeed, there are no circumstances arising from the nature of the situation that prevents their being formed in a regular manner, the size of the farms and the course of the crops that can be most beneficially cultivated on them

* Anderson's Essays, Vol. i, p. 158.

should be principally regarded ; as by their being thus made to suit the nature and extent of the farms, conveniences may be gained in the business of cultivating them, as well as in taking off their products, that no other mode of division could probably afford.*

" It may, on the whole, probably be concluded, that the more equable, in respect to temperature, such fields as are intended for pastures can be made by means of judicious fencing, provided they be properly drained, and a due circulation of air preserved, the better they will fatten the animals that are kept in them ; but that in grounds where grain and root crops are to be cultivated, except in elevated, hilly, and very exposed situations, the size of the inclosures should be larger, and the fences less calculated for the purposes of shelter, as the free and equable admission of air has great power in rendering the growth of such kinds of crops healthy and vigorous, as well as in preventing them being injured by a variety of causes to which, under other circumstances, they must be exposed : besides the health of mankind, as has been already observed, would in many cases be considerably benefitted by the adoption of such a system of inclosure."†

With regard to the *shape* of fields, although this must be in some degree influenced by the hilly or level situation of the land, yet it is evident, that it is most advantageous to have the fences in straight lines ; and that the fields, when large, should be square, and when small, more especially in turnip soils, of an oblong form ; in order that the ploughing may be dispatched with as few turnings as possible. In hanging grounds, however, the ridges and furrows ought always to have so much obliquity, as to reduce the field nearly to the circumstances of one situated on a plain. The operations of ploughing, harrowing, carting, &c. will thus be materially facilitated, and the filling up or sanding of the furrows will be effectually prevented.

Some persons, whose farms are of a waving or uneven surface, and who inclose with hedge and ditch, carry their ditch through the hollows or best soil, with a view of raising a good hedge ; thus frequently sacrificing the form of the field for the

* Robertson's View of the Agriculture of the county of Perth.

† Dr. Dickson's " Practical Agriculture," Vol. i. p. 149—151.

sake of the fence. But, even in such situations, a straight line is preferable, though it should be necessary to bestow some labour and attention to enrich the soil for the thorns, when it is thin and poor, on any elevated situation. By means of the square form of fields, an opportunity is afforded, of ploughing *in every direction* when necessary, and less time is lost in carrying on all the operations of husbandry in a field of that form, than in one of any other shape. Where the waving form may be necessary to secure a proper course for the water, Sir John Sinclair directs the plants to be so disposed as to reduce the fields to squares or oblongs, and the fences to straight lines.

SECTION V.

O F F E N C E S.

FENCES, in rural economy, comprehend, in general, every sort of inclosure that is employed for shelter, or to protect the lands inclosed from the intrusions of cattle. They are of various sorts, and formed of various materials, according to the peculiar circumstances of situation, &c. At present we consider those peculiarly belonging to a farm, and which may be classed under the heads of banks or walls, hedges, ditches, and gates.

I. *Earth banks* are chiefly employed in those districts where other materials for constructing fences are difficult to be procured. The best mode of forming such banks is, to dig up some turfs in a spot abounding with grass, about one spit deep, and four or five inches in thickness. These should be laid even on one side by a line, with the grass outwards; and on the back of these is to be placed another row of turf, leaving a space of one foot of solid ground on the outside, in order to prevent the bank from slipping or falling in, in case any part of it should be deficient. On the outside of this is to be excavated a ditch, otherwise it will be necessary to make both sides with a slope two feet deep; but this will not materially affect the fence, as both sides will produce pasture. The earth which is dug out of the ditches, or from the slopes, ought to be thrown in between the two rows of turf, till the whole is made level in

the same manner, and the bank becomes four, five, or more feet in height, the width of the foundation being at the same time increased according to the width of the bank. In proportion as the bank ascends, the two sides must be made gradually to slope, so that the top shall be about two feet and a half wide. It should, however, be uniformly regarded, in forming earth-banks, that they never be constructed or raised in dry weather; for, in the event of sudden or long-continued rains descending, the soil between the sods would swell and bulge out, and of course materially affect, if not totally destroy, the solidity as well as the symmetry of the banks. The top may be planted with quick, or any of the other shrubs useful for fencing, which will be stated in the course of this section.

II. *Walls* are the most usual kind of fence in those districts which abound with stones; when well constructed, they are of great durability; and in all situations where stone can be obtained at a reasonable price, stone walls, though not so ornamental as hedges, are every way preferable in point of utility, because the benefit is immediate. The fossil used for this purpose may be lime-stone, rag-stone, or grit-stone, or any other kind that is most convenient; though lime and grit are preferable to other, on account of their being in greatest abundance, and most easily wrought. Walls are either made with stones only, in which case they are termed *dry stone walls*; or with stones and earth intermixed, when they are called *earth and stone walls*; or with lime and mortar, in which state they are denominated *lime and stone walls*; the last mentioned, though possibly more expensive in the first instance, are ultimately the most durable, and consequently the best adapted for fences.

In constructing stone walls, the foundation ought to be about two feet and a half in width, the wall tapering upwards to ten inches or a foot, and thence to fifteen or twenty inches. The foundation should be placed at such a depth in the ground as to be totally unaffected by frosts; the wall should be carried up to the height of six feet, and coped at the top with stones placed edgeways; and where dung is laid against it, the height ought to be still greater, in order that the coping may be out of the reach of the stock. Where lime cannot be procured to cement the stones together, a dry wall may be constructed in the same manner, which, if judiciously arranged, will last nearly as long.

And, as soon as the wall is completed, a ditch should be dug on each side, from eighteen to twenty-four inches in depth, at the distance of about one foot from the root or foundation of the wall, which will not only be thus kept dry, but will also contribute to the security and durability of the fence, by preventing cattle from approaching too near to the wall.

III. *Hedges* constitute another useful kind of fence, especially in those situations where no materials for walls can be obtained. They are usually formed by intertwining the branches of trees, and are commonly distinguished, 1. Into those intended for the protection and ornament of gardens; and 2. Into *outward fences*, or hedges, which are employed for sheltering and defending fields. In forming hedges of the last-mentioned description, in which we are chiefly interested, every attention should be given to have the plants as nearly as possible of the same size; although the nature of these will necessarily vary according to the quality of the soil. Thus, for wet or swampy places, that are liable to sudden inundations, the alder, willow, (or preferably to this the white-thorn), and osier may be beneficially employed: on dry, sandy situations *furze* may be made use of with great advantage, if it be planted at a proper time, and managed with care. For this purpose a bank should be raised, five or six feet broad at the top, with a proper ditch on each side, the surface of which is to be thickly sown with *furze* seeds. These will speedily vegetate, and in the course of two or three years will form a fence that will continue for several years, and resist the efforts of most animals. As, however, the *furze* increases in size, the old prickles will decay, and consequently leave the lower parts of the stems exposed, so as to afford an entrance to cattle; this inconvenience can only be remedied, or rather prevented, by gradually supplying the bank with new plants, which should not be permitted to shoot up to such a height as to leave the lower parts naked; thus, if one side of the hedge be cut down close to the bank, the other half will continue as a fence, till the former part attains a proper size, when the opposite side may be cut down in a similar manner; so that the bank will always have a strong hedge upon it, without being liable to become bare at the roots.

Among the plants which have been recommended for putting into hedges are the following:—1. The *black thorn*, the growth of which is less certain than that of the *white thorn*: though the

bushes of the former are superior to those of the latter for mending dead hedges, being less liable to be cropped by cattle.—2. The *white thorn*, which grows very rapidly, is very durable, and will flourish in almost any situation, except gravelly soils: they are best calculated for this purpose when about one or two years old, and should be transplanted from a rich, fertile nursery. Thorn-hedges are unquestionably the best materials for this purpose, whenever the soil is suitable, or can be rendered fit for them.—And 3. The *holly*, though slow and less certain in growth, is said to be superior to either of the former plants for making quick-set hedges; and by its thickness, and strength, fully compensates for the delay and expense incurred.

The best mode of making hedges with these trees is, first to mark out the line of ground, and, by ploughing or digging, prepare it for the purpose; the young plants, having been carefully removed so as not to hurt or injure their roots, are then to be placed in the ground, in proportion of four or five quick or white-thorns to one holly. Both will flourish; and, as the hollies increase in size, the thorns may be pulled up, and when the former have attained their full growth, they will occupy the whole space, and form a most permanent fence. Should any intervals occur, they may be easily filled up by bending down the lower branches, and covering them with earth; in the following year these will take root, and shoot forth so as to present an impenetrable barrier. It is well-known, that white-thorns do not flourish to advantage on dry, gravelly, thin soils: the reasons assigned for this circumstance by Mr. Leatham (in an interesting communication inserted in the "Transactions of the Society of Arts," Vol. iii.) are, 1. That they are set too low or too flat on the surface to allow the roots to strike deeply into the soil. And, 2. When planted higher, they are generally too near the slope of the bank, so that they cannot receive any benefit from the rain. The remedy he proposes for these inconveniences is, to make out two lines, twelve feet asunder, and to take the upper part of the soil from three feet within each line, and to throw it into the centre of each space, so as to form a flat bed three feet broad; in the middle of this are the quicks to be planted, and the remaining space of one foot and a half is to be filled up with the earth or soil taken out of the ditches on both sides; so that the bed is extended to five feet, allowing six inches for the slope of the

bank. Quicks thus planted will meet with sufficient nutriment in the soil, before the tap-roots reach the barren, gravelly bottom; and the earth thus placed will retain sufficient moisture to nourish the plants, which will in a short time form an excellent fence. Mr. L. states, that by elevating the bank on each side, at pleasure, the thorns may be protected at a small expense from the ill effects of sharp winds, or sea air; and the benefit resulting from such kinds of hedges more than compensates the expense of making them. At the time he communicated his remarks to the Society above mentioned, a rod (fifteen yards) of fence, made in the manner already stated, cost him 1*s.* 3*d.*

As thorn or quick-set hedges are not more admired for their beauty than their utility, the following account (communicated by an intelligent correspondent) of their culture and management, in Northamptonshire, may form a proper supplement to what has already been stated.

The largest haws being gathered in the autumn, from the finest and healthiest growing thorns, to the amount of one, two, or three bushels, according to the quantity which may be wanted, are first put in pits or holes, to clear them from the pulp, and in the spring are sown, not too thick, in beds, duly prepared as if for onions, about the breadth of asparagus beds, with paths between for convenience of weeding, &c. Sift over these a quantity of fine earth, sufficient to cover them equally about half an inch. Observe to keep them very free from weeds throughout the summer; and the next or following spring, according to their size, thin and transplant them into rows in narrow trenches across similar beds, the rows being about three or four inches distant, according to the strength of the plants, to remain till the following spring: keeping them clear of weeds in every stage is of the most essential importance; which not only expedites their growth, but prevents mildew (to which they are very liable in damp, foggy weather, and unfavourable seasons), that checks the circulation of the sap, and injures their progress. If the mildew affects them in the spring quarter, they will often revive at Midsummer; but afterwards, it commonly stops them for the rest of the year.

About the latter end of March, or early in April, which is the best season both for sowing the seeds, transplanting them in the beds, and removing them to their stations in the fields,

&c. draw out the best of the young plants, from one-eighth to one-fourth of an inch in thickness, which will sooner take root than larger ones, and form them into bundles of 1000 each, the ground being first prepared for planting them, by cutting out a small trench, not deeper than the good soil, on each side of the proposed fence-row, and throwing it over the turf, on which the plants are to be deposited. Hollow it out in the form of a bason or punch-bowl, in the outer side of which the plants are fixed, which should be rather higher than the inner side; first sloping off by a line of equal height from the bottom of the hollow, in the fresh earth which is thrown up, to form a bed for the plants. Having first cut off the small end of the plants, so as to leave only two or three buds above ground, when planted, or at the utmost about three inches, cut off also as much of the root end as to have only about four or five inches in the ground, when covered with earth, taking care to leave on some of the tender fibres of the root, slightly trimming the fine ends with a sharp knife. These may be placed about three inches asunder, a little more or less, according to the strength of the plants, so that 12 of these will extend a yard, and 264 a chain, or, what they call for that purpose only, an acre. Having covered a sufficient length of these, and the side inclining as before, another line is to be sloped off, about three or four inches above the other; in which another row of plants is to be deposited in the same way, and at the same distances, and covered with earth as before, care being taken to place each plant in this upper row against the intervening spaces of the plants in the lower row. This row will, therefore, contain as many plants as the other; and both of them about 528 plants in a chain or acre of 22 yards in length. Then finish off the inclination of the sides, with a small flat or hollow on the top above the upper row, and so proceed until the whole is finished. The sooner the plants are thus deposited in their new situations, after removing from the seed-beds or nursery-beds, the better; but especially, be careful to put them in speedily after cutting and trimming; before the sap dries up, and no time should be lost in laying them in their places, whilst the natural moisture continues in the soil from the trenches, both for bedding and covering them. On these minute attentions, especially if the spring should be afterwards dry for some weeks, their taking root must greatly depend, as must be obvious to common sense.

The hollow or bason form of managing the ground for planting the sets is an essential consideration, though in many other counties greatly neglected. If the weather should prove dry, it serves as a reservoir for collecting at least every particle of moisture which falls in the space between its extreme edges, whether by dews or partial showers; which serves to feed the roots of the plants, which are just above it and will soon strike down towards it, and also prevents weeds, when duly attended to, from injuring the roots and robbing them of their nourishment. In the growth of these plants, therefore, the weeds, which will naturally push forward; must be kept under by hand-hoeing and weeding, both above and below the rows of plants, as well as between them; which will also have the effect of fitting the soil to receive the full benefit of the night dews, &c. This hoeing and weeding was constantly performed four times every summer, for each of which they were then paid sixpence an acre of 22 yards, or two shillings a year. Early in the spring, before the hay-harvest, and before and after the corn-harvest, were the usual seasons of performing these operations.

But all this trouble and expense and precaution would be of little use, if no care were taken to preserve these fences from injury. It was usual, therefore, and no doubt is still practised, being a woody country, to provide rough posts for each side of the bank, at distances to be estimated by the length of rails, of equally rough materials; three of which are kept together by mortises in the posts, and thus forming a secure fence against great cattle, the posts being placed at such a distance on each side from the plantations, that the cattle cannot put their necks over to crop them. And when sheep or lambs are put in the ground to feed, &c. furze or loose thorns are drawn into the rails, to prevent them being damaged.

Where any plants have accidentally failed, they are replaced on the first Spring hoeing regularly by fresh sets. In two years commonly; or three years at most, where this care is taken, the soil is not very stiff and barren, the plants will have gained sufficient strength to be cut down to about seven or eight inches high; which will cause them to shoot out very strong and thick, and in two or three years more will become a fence sufficient for any moderate purposes, and with a little longer care will be competent for every necessary defence. Before this time, the posts will begin to decay at the feet, and must be

occasionally repaired and guarded ; but common attention will always obviate any serious injury, and need not be an object for particular direction.

A practice of a less minute and circumstantial nature, prevailed some time since in the adjoining county of Bedford, where less attention was paid to the articles of hoeing and weeding ; and the consequence was, that fences which had been planted ten years, and attended with the expense of two sets of posts and rails, were in a less promising state than those above noticed, though within a few miles, were in three years. Indeed it was doubted at that time, whether those alluded to in Bedfordshire could ever make a fence ; and whether they must not be planted wholly anew, and a similar management pursued to what has been stated. In some part of Wiltshire also, especially on the western limits, towards Somersetshire, an absurd mode of planting, as well as a carelessness and inattention afterwards, strongly prevails ; where secondary plantations have actually been made in single rows, but without any of the precautions above mentioned, and if no guard or preservatives be provided beyond mere temporary expedients, these will succeed no better than the former.—Where ornamental hedges are intended to be cut, three rows of plants will be necessary in the same quincunx order as above.

In addition to the plants which have been recommended for constructing fences, may be noticed the *horn-beam* tree, which is chiefly used on the continent ; it is propagated from slips or sets, and will thrive admirably well on poor, barren, and exposed lands. The slips, or layers, are planted on an earthen parapet, with a ditch on each side, in such a manner that every two plants may intersect each other ; the bark is then scraped off the spot where they meet, which is covered with bands of straw : thus the two plants become united, and put out horizontal, slanting shoots, forming a very strong palisade, which, if carefully lopped or shorn every year, will render the whole hedge utterly impenetrable to men and animals. The *elm* has likewise been brought forward to public notice, as being calculated for fences : when elm timber is felled in the spring, the chips made in trimming the trees are to be sown on a piece of newly-ploughed land, and harrowed in. Every chip which has an eye or bud will speedily shoot, like the cuttings of potatoes ; and as elms have no tap-roots, but strike their fibres *horizontally*

in the soil, they will be more vigorous, and may be more easily transplanted than if they had been raised from seeds. Another advantage stated to result from this method is, that the same chip or bud will produce five or six stems; and, after being cut down to within three or four inches of the ground, the lateral or side shoots will proportionably increase, and form a thick hedge, without running to wood; and if they are carefully clipped every third or fourth year, they are said to become almost impervious to any cattle whatever.*

Privet, when planted with the hawthorn, makes a good close hedge, if it be well kept: it is a well known and beautiful shrub, flowering in June and July, and preserving its verdure almost throughout the year: it scarcely sheds its leaves till March, which re-appear in the following month. It delights in pretty dry and friable soils, and puts forth many trailing branches, which take root when they come in contact with the earth, and its cuttings grow very freely.

In addition to the valuable shrubs, we may mention the *American cockspur thorn*, (*cratægus crus-galli*, L.); which the late misunderstandings between the British and American governments frustrated the patriotic endeavours of the Board of Agriculture to introduce into this country. As peace is now happily re-established, we doubt not but it will be familiarized to our climate; and, in this hope, subjoin the following account of it, by an intelligent American farmer, who has been most successful in rearing this thorn.† This shrub grows to the height of ten or twelve feet, and has a strong stem: its bluish red flowers, which blow in June, are in roundish clusters; and its haws or fruit are of a globular form, having a fine red colour. Mr. Neill's instructions for cultivating this beautiful and valuable shrub are as follows:—

“First lay down stone convenient to the spot where you intend your fence, say one cart load of middle-sized stone to 15 feet;—then run your line where you design the front of your bank, and close to that line lay one row of stone compactly together; then move your line 12 inches out, towards where you design to dig your ditch: the last 12 inches remain in front of your

* ‘Letters and Papers of the Bath and West of England Society,’ Vol. i.

† Mr. Neill of Delaware county, Pennsylvania. Transactions of the Philadelphia Agricultural Society, Vol. iii., pp. 11 *et seq.*

bank, to keep the frost from working under, till the roots grow through to bind the earth together, which they will do in three years:—with a spade cut along your line the depth of a good sod, keeping the face of your spade always in towards your ditch: then lift your line, and lay it four feet apart from the last, and cut with the spade as before; then sod off the four feet between the last two lines, and throw it back behind your row of stone: let the mother earth on your sod be mashed fine with the spade, and drawn in with the hand carefully to and over the stone to the depth of two or three inches, then lay your thorns in an horizontal direction, the top rather inclining upwards, at six inches apart. Advancing two or three inches through the stone, carefully drawing the nicest mother earth with the hand over the root; the next row is of middle-sized stone, (but be as careful as possible not to pinch your plant between flat broad stones,) and go on with row of stone and layer of earth until your bank is three feet six inches high, your ditch three feet deep, carried down so as to meet at two feet at bottom: in raising the wall in front of your bank, carry it up almost plumb, for as your earth settles down, your wall will lean back and become too shelving.”

Mr. Neill trims his hedges either in the spring or fall, but not at both seasons, as the growth is injured by the trimming. Many are the advantages derived from his method of rearing the cockspur thorns. Besides the farmer receiving immediate benefit from it, when first made, many other advantages attend it. Hedges made of these thorns are more easily kept clear of weeds: the weight of the bank keeps a moisture about the ground: they stand dry seasons better, grow more quickly, and are not half so liable to die, as when planted in the other common way. The banks are in no danger of being undermined by frosts after a year or two, nor indeed are they in much danger from these at any time. Good ground always produces the best hedge if managed properly: and though Mr. Neill had but very poor soil, which was also high and dry, yet by manuring it, accompanied by diligent attention, he has thorns of four successive years planting, perhaps not excelled in any country. The cockspur thorns, however, must be kept as much as possible from the shade of trees.

Further, beech and birch trees are said to form, with proper care and attention, excellent fences, and in a short space of

time, in very elevated and exposed lands; it has also been suggested, that great advantage may be derived by planting cyder fruit-trees ("Letters, &c." Vol. ii.); as the profit they then would yield, would amply counterbalance the expense incurred in rearing them, without losing any ground, as the uncommon acidity of the best fruit, at the time of gathering, will effectually secure them from depredations.

The proper season for hedging is in the autumnal quarter, whence it may be continued through the winter, as opportunity may allow, or circumstances may require. Mr. Young very judiciously advises the farmer to get his fences into good order during the three first winters of his lease; and afterwards to divide them into twelve portions, one of which may be done every year, which will bring the whole into regular cuttings. It is, however, an erroneous, though common practice, to cut thorn hedges every year; for, though it confessedly promotes the *beauty* of the fence as it respects *appearance*, yet this beauty is attained at the expense of strength and durability; inasmuch as the stems are impeded in their growth, and become small and weak. On the contrary, if they be carefully lopped or clipped every seventh or eighth year, with a sharp pair of shears, *in a sloping direction on both sides, from the bottom to the top*, there will not only be a very material diminution in the labour, but the hedges will also become more close and vigorous, and will, in succeeding years, only require the most prurient lateral branches to be shorn off in the manner above directed. The proper season for this purpose is, in the autumn, when the circulation of the sap is less vigorous, and consequently the plants will not suffer materially from the loss of their sap.

The growth and durability of quickset-hedges may be materially promoted by *plashing* them, an operation which is performed in the following manner. In the first place, the labourers clear the old hedge of all dead or decayed wood, brambles, and other irregular growing rubbish; leaving along the top of the bank the best and straightest stem of elm, thorns, beech, &c. in the ratio of five or six to one yard; though if there be any *gaps*, or spots, which are thin of live wood, a larger number is left on each side of such spots. Next they repair the ditch, all the earth arising from which must be thrown on the *bank*, and by no means laid on the brow of the ditch, unless the ditch earth happen to be extraordinarily rich, and will pay well for the ex-

pense of carrying it to the land; otherwise the grass of the border will be spoiled, and an unnecessary charge be incurred. The ditch being thus completed, the men commence their labours upon the hedge. Such of the stems left in cutting the old hedge, as they find growing in the line where the new hedge is to run, they cut off three feet from the top of the bank; in order to serve as hedge-stakes to the new hedge. This practice, observes Mr. Young, (Farm. Cal. p. 26.), cannot be too much commended; for these stakes being immovable, and never rotting, keep up the new hedge; so that it never falls or leans either way. In the next place, they drive in dead hedge-stakes where it is necessary, choosing willows or willows, that they may grow. The hedgers then plash down the remainder of the live wood left standing: they cut the stick twice, once near the ground, and again about ten or twelve inches higher, and just deep enough to slit out part of the wood between the two; leaving the stem supported by little more than the bank, or about a quarter of its first size. It is then laid along the top of the bank, and woven among the hedge-stakes: in this manner the whole are treated: and where the plants are not sufficiently thick to finish the hedge, dead thorns are interwoven, and the top of the hedge is *eddered* in the common method.

The business of plashing hedges is sometimes performed in October, but more generally towards the end of January, in February, or in March: this latter season is the most advantageous, as the plants, which have been divided or cut during the operation, will be less susceptible of injury from the vernal frosts.

The fence thus made consists of a good ditch, and of a hedge, of which the principal parts are alive—a point of the greatest importance, as such management insures a lasting fence; whereas hedges, that are entirely dead, rot in a short time, and fall into the ditch.

IV. *Ditches* are cut with various intentions, either to serve as drains, or for fences, or alike for both purposes. Ditches are generally allowed six feet in width, where they are at the side of highways, and five feet in commons. Those which are made or repaired at the feet of banks on which quick-set hedges are raised, Mr. Young advises to be in no case less than three feet by two and a half, and six inches wide at bottom, in the driest soils; but in all wet or moist ones, never less than four

by three, and one at bottom. Thus each side acquires a slope, which is of great advantage, and indispensably necessary; for, when ditches are cut perpendicularly, the sides are continually washing down. Whatever be their purpose, whether for drainage or for fencing, ditches ought to be so constructed, that the water they contain may never become stagnant, but pass off into a contiguous rivulet, or brook; they should likewise be occasionally cleaned out, and the mud thus obtained will defray the expense of the additional labour; as it will, when mixed with other matters, form a useful compost for manuring lands.

V. *Gates* are of various forms and denominations, according to the manner and materials of which they are made. The wood usually employed for this purpose is oak, ash, beech, and other solid timber; though the Dutch willow, and some lighter kinds of wood, may be beneficially converted to the same purpose. In constructing gates, the chief points to be attended to are, the *fixing* of the post so as to resist the attacks that are often made by the forcible swinging of the gate, and the *hanging* of the gate itself, so that it may shut easily and truly, without dragging on the ground.

With regard to the gate-post, where timber is used, it ought to be either prepared by tar, pitch, or oil-paint, in that part which is intended to be deposited (and such posts should always be fixed firmly and deeply) in the earth, or by charring; and all that is above ground, exposed to the air, should be covered with one or two coatings of oil-paint, which will be attended with comparatively little expense, while the advantage thence derived, in point of durability, will be very considerable. Gate-posts will also be more durable if their *natural position be reversed*, that is if the top be put down into the soil, and that part which was nearest to the root be placed out of the ground. No reason has hitherto been assigned to account for this very important fact, which cannot be too extensively known where timber is used for gate-posts. Stone gate-posts, however, are preferable, where they can be conveniently made of hewn stone; yet, even these are liable to be materially injured by the frequent shaking, or swinging, of heavy gates against them; or, by careless drivers running the axle of their carts against them. To prevent such inconveniences, Lord Kaimes suggests, instead of building a wall or post in *the line* of the inclo

sure, to erect it *perpendicular* to it, seven or eight feet in length, thickest in the middle, and tapering towards the ends; and is of opinion, that such a post will resist any force whatever.

For convenience, in point of size, and security to the farmer, *five-barred* gates, properly braced, are perhaps preferable to any others: the dimensions of such a gate should be from eight to eight and a half, or nine feet, in width or length, and from four to four and a half, or five feet high; the bars should be strong, and three inches and a half deep, and the lower ones so arranged as to prevent small cattle from squeezing through them into the field. The common gates are usually hung on hooks and thimbles, and fastened with latches or catches, without regarding the adjustment or proportions of the whole, with regard to their tendency or difficulty in shutting. With a view to remedy this inconvenience, it has been suggested, to make the lower hinge circular, to move in a groove of the post, instead of having two forks to fall on bars driven into the post. By this contrivance it will be impossible for swine or other cattle to throw the gate off, by creeping under it. With the same view it has also been recommended in the "Agricultural Survey of the County of Northumberland;" after perpendicularly fixing the hanging post on the ground, to draw a plumb-line upon it. On this line, at a suitable height from the top, is to be placed a hook, so as to project three inches and a half; and, at a proper distance below this, another hook is to be put, one inch and a half to one side of the perpendicular line, and so as to project two inches from the face of the post. The top loop, or eye, is next to be placed two inches from the *haw-tree*, and the bottom loop three inches and a half from it. Gates hung upon this principle are said to possess a sufficient fall, in every situation, and will shut without any difficulty.

SECTION VI.

CULTURE AND MANAGEMENT OF GRASS-LANDS.

THIS branch of rural economy, which to a grazier is by far the most important, may be considered under the respective

heads of *pasture*, or that which is exclusively appropriated to the feeding of cattle; and *meadow*, or *hay lands*, which, as the name implies, are chiefly reserved for making hay.

I. PASTURE.

The nature and excellence of pastures depend greatly upon situation, and the different classes of animals for whose use they are intended. Thus *uplands*, or such lands as are considerably more elevated and dry, will be found most beneficial for feeding sheep; while neat cattle may be fattened to the greatest advantage in those which are lower in point of situation, as well as more inclosed. Further, it has been found that the older pastures are best calculated for feeding or fattening stock, while *new lays* (that is, such as have not long been laid down for pasture) are more fitted for feeding young store cattle; and that the size or extent of the inclosure likewise influences the application of pastures.

In laying out pastures then, the first step to be taken is, the division of the land into fields or inclosures, which may contain four, five, six, or more acres; but, in general, it may be remarked, that the larger or more extensive inclosures are less adapted for feeding, than fields of a moderate size: next, the whole ought to be fenced with good hedges, of such a height that cattle cannot easily overleap them, so that they can feed more leisurely, as well as more securely; and it is recommended to plant timber-trees at proper distances, in order to afford a shelter from tempestuous winds. But much caution is necessary, not to make the inclosure too small, especially when the hedge-rows are to be planted with timber-trees; because the grass will become sour if these are disposed too closely together, and consequently will greatly injure the pasture.

Pastures, like other grass-lands, are liable to be infested with *weeds*, as well as with *ant-hills*, *mole-hills*, and other obstructions to the plough and scythe; the former ought to be carefully eradicated towards the end of summer, before the seed-lobes are formed; and, when sufficiently dry, they may be burnt, and their ashes spread on the land previously to the falling of autumnal showers. All mole and ant-hills should be

pared off with the plough and burnt, and their ashes spread on the earth.*

Nothing improves pasture land more than a judicious top-dressing; although it must be observed, little comparative regard is, in general, bestowed on this subject. Thus, if the land has not been limed, a good liming, either of that fossil in its natural state, or in the form of a compost, will be found of very great service; marl, well rotted dung, or the compost already mentioned,† may be spread in like manner, regularly over the soil. The folding of sheep on pastures, while they are fed or fattened with other succulent food, will prove of essential advantage; because the dung thus dropped will be both richer in point of quality, and more in point of quantity, than it could possibly be, if they were fed or pastured on grass alone, without the aid of any other food. At the same time the sheep will contribute partially to check the too luxuriant growth of the grass, which will consequently unite at the bottom, and thus produce a sweet and tender herbage.

As the choice of seeds proper for laying down pastures will be stated, and the best sorts, together with their culture, will be pointed out in a subsequent section, and as, we trust, an accurate view of the comparative advantages capable of being derived from the hard or light stocking of pastures have been already stated, (pp. 130—132,) we proceed to consider the proper time for turning cattle into pastures.

In addition then to the intimations on this subject, which have been given in a former section,‡ we would observe, that from the latter part of March to the close of April, or early in May, will, in the warmer districts of the southern counties, be found most beneficial, in proportion as the season is more or less backward; but, in such as have a more northerly situation, the turning of cattle into the pasture may be delayed for one or two weeks, or even longer, with considerable advantage. The result of this practice is, that the cattle will eat off the central stems of the grass-plants, in consequence of which, as Dr. Darwin has justly remarked, new leaves are produced around the first joint of the stem thus grazed; and, as this

* Concerning the destruction of ant and mole-hills, see Chap. VI. Sect. II. pp. 304, 305.

† See p. 379 on Compound Manures.

‡ Chap. III. Sect. II. pp. 126, *et seq.*

management is equally applicable to meadows, a more abundant crop of hay will be produced.

Various expedients have been recommended for the improvement of pastures; among these the practice of *scarifying*, previously to the spreading of manure, has been found singularly serviceable.* The ground may also be rolled twice or thrice in the course of the spring, at proper intervals, with much benefit; because the grass will be compressed, and acquire a thicker bottom. And, as clovers strike roots from every branch in contact with the ground, they will unite so closely as to present a fine, thick sward, that will shelter the whole surface of the pasture, and flourish amid the most parching droughts.

A peculiar, but excellent mode of improving poor or indifferent pastures is practised in Yorkshire, and also in the county of Cardigan, which merits the attention of the intelligent agriculturist. The farmers in those districts put up their pastures as soon as they can in May, for the summer season; and during that period no other attention is given, than to remove all noxious weeds. Thus the lands remain unoccupied till December, when the grazing stock are turned in, and every animal is stated to be in excellent condition without the aid of hay, straw, or oats. The winter frost sweetens the grass, which continues uninjured by the snow; but, while the ground is covered with the latter, dry food ought to be given to the cattle. In the ensuing spring, young shoots of sweet grass will spring forth from beneath the shelter of the old grass plants, and both will be eagerly eaten; while, throughout those two seasons, the milk and butter will, it is said, prove in every respect equal to that which may be made at any other period in the year. The advantage of this practice is obvious on lands that have become infested or overrun with moss in consequence of hard stocking, or being grazed too bare; as such pastures will be shortly covered with sweet herbage, and the moss will disappear without requiring the assistance of the plough, or of any surface manure or top-dressing.

II. MEADOWS.

Under this head are included, as already hinted, those grass-lands which, lying for the most part in low or moist situa-

* See pp. 263, 264, where an engraving is given of a useful scarifier, invented by Mr. Macdougall.

tions, are reserved chiefly for the making of hay. Before we proceed to discuss the various particulars connected with this department of our labours, it may not be useless to observe, that as the present work is chiefly calculated to assist those who are exclusively occupied in the *grazing and feeding of cattle*, the subject of tillage-lands will be introduced so far only as these are auxiliary to the farmer in affording a variety of vegetable crops, which are adapted for supplying him with succulent food for his stock. And, as there are some soils which may be beneficially employed in tillage, while others may, with more profit, be constantly kept in grass; the management of the former will be noticed in the following section, while the system of treatment proper for meadows will be immediately detailed.

It has been justly observed by an intelligent cultivator,* that the great difficulty is to discriminate what species of land is fit for grass, and what is not. The best meadow-land does not always make the best tillage-land; nor does the best arable produce the best pasture, but frequently the reverse.

The lands which are most proper to remain in grass, and which, if in a state of aration, ought to be converted into grass, are the following, viz.

1. Lands in the vicinity of large and populous towns, where manure is cheap and plentiful, and where the produce of grass-land is always in demand, and consequently dear.
2. Lands situate near rivers or brooks, which are capable of being improved, by irrigation, to a much greater value than can possibly be effected under any other mode of culture.
3. Lands lying in the valleys of mountainous countries, particularly calcareous soils; where old meadow-land is scarce and valuable; and where the greater part of the arable land is of such a nature, that it is almost impossible to convert it into good grass-land.
4. All cold, strong grass-lands, which, if ploughed up, would be inapplicable to the growth of turnips, and to the general purposes of modern husbandry; and which, under

* Mr. Davis, in "Communications to the Board of Agriculture," Vol. iii. p. 60.

the best system of wheat husbandry, would not be so valuable as they are now in a state of grass. An exception however occurs, with regard to land of this description; for, where sea-sand (as is the case on the north-western coast of Cornwall) can be applied, at an easy expense, as a manure, such land may be more profitably employed in tillage.

5. *Peaty soils* are also best adapted to the purpose of yielding grass; for, though they may be most perfectly reclaimed, from producing rank aquatic plants by tillage, yet, being too tender and too moist to continue long in a state of aration, they should be converted to the state of permanent grass-land as soon as that object is accomplished.*

It ought to be observed, that land intended for grass ought to be that in which it will spontaneously thrive and flourish; consequently, if there be too much moisture, the grass will be injured in the winter by rain and frost, and will soon be superseded by rushes, and other aquatic plants. On the other hand, if the land be too dry, the grasses will be killed by the intense heat of summer, and be succeeded by mosses, fern, heath, &c.

No land will make a good meadow, unless it be sufficiently deep to admit the roots of grasses to run down out of the reach of the summer heat, and also sufficiently retentive to hold water long enough to produce fermentation, together with such an absorbent substratum as will drain it before putrefaction takes place; and, if it be not so by nature, it must be rendered so by art. On the contrary, if land be too dry and friable, ploughing will only render it more so. Grass-land of this description, therefore, Mr. Davis observes, ought never to be ploughed, unless it can be made retentive by the application of lime, clay, chalk, or other fossil manures that can be procured on or near the spot, especially marl. Where either of these can be obtained at a moderate expense, and where good crops of grain have not only been produced, but also a tendency is promoted in the land to run again to grass-land of this description, that can be so managed, should be ploughed

* "Communications to the Board of Agriculture," Vol. iii. pp. 79, 80, &c.

up, and after being a few years in tillage, particular care being taken not to exhaust it by corn-crops, may be again laid down to grass in a much better state than it originally was.

Beside these various considerations, there are other circumstances of very material moment in the laying down of lands for meadows; which, however, have not (at least till within a few years) been regarded with that attention which their importance requires. In fact, whoever examines the composition even of our best pastures, will find them to consist of a mixture of plants, altogether dissimilar in their nature and properties; and that, with the exception of such as have recently been laid down with rye-grass or clover, they will prove, as a late eminent and amiable botanist* has justly pronounced them, to "be pretty much in a state of nature; full of an indiscriminate mixture of plants, some of which afford good, others bad food; some good crops, others scarce any crops at all."

The following principles, or requisites, will be found worthy of every person's notice, who designs to lay down land for a state of grass.

The grand requisites then towards obtaining a good meadow are, a perfect acquaintance with the best *natural grasses*, their *peculiar soils*, and the best mode of collecting or procuring their seeds.

1. As the best natural and artificial grasses will be enumerated in a subsequent page, we shall at present only remark, that the tendency to promote the thriving and fattening of cattle is an object of essential importance, with which we are as yet but little acquainted, except in the case of the *artificial grasses*. Hence, as far as it is practicable, every intelligent agriculturist will endeavour, by experiment and minute observation, to ascertain those plants which promise to be particularly useful in this respect, and which have not as yet been cultivated *separately*. As, however, leguminous vegetables have generally proved to agree with live stock, Mr. Curtis is of

* Mr. Curtis, in his "Flora Londinensis." This same remark occurs in his "Practical Observations on British Grasses," 8vo.; a work with which every grazier ought to be intimately acquainted.

opinion we may reasonably infer, that a certain proportion thereof may be useful and beneficial on grass-lands.

An *early growth* is of equal moment; especially as, from a variety of unforeseen accidents, the most careful and intelligent farmer may not have a stock of food adequate to the consumption of his cattle. The seasons, indeed, must ever produce great changes with regard to the forwardness of grasses, and the reverse; and hence the necessity of having warmly situated and not too humid inclosures, of a moderate size and well sheltered, as already intimated, will be more clearly obvious, because, in this case, the ill effects resulting from severe winters, or from the prevalence of north-easterly winds during the spring, in keeping the herbage backward, will, Mr. C. remarks, be counteracted as much as is possible for man to counteract them. In fact, the early grasses, the best of which will be specified in the ensuing chapter, appear to be most coveted by cattle, which of course will thrive best on what is most agreeable to their palate; so that an early bite, an early hay-making and hay-harvest, and consequently the early use of the after-grass, or *rouen*, are important objects to the farmer.*

2. An acquaintance with the *peculiar soils*, and relative hardness of grasses, is another requisite, without which no good meadow can be formed, and which can only be derived from actual experiment. Thus some are less able to endure moisture than others, and of course flourish most in the *drier* situations; while others are totally unfit for dry soils, but vegetate luxuriantly in *moist* lands; and others again are only fit for the most *barren* lands, which are unfit to rear any other kinds of grass. Of the *first* description are the smooth-stalked poa, or smooth-stalked meadow-grass, saintfoin, &c.: of the *second* are the rough-stalked poa or meadow-grass, the flote-foxtail and flote-fescue, water poa or meadow-grass, &c.; and to the *third* belong the sheep's fescue, hard fescue, &c. &c. There are likewise numerous grasses which delight in almost any soils, except the extremes of wet and dry, which it will

* Mr. Tollet, in "Communications to the Board of Agriculture," Vol. iii. p. 427.

be unnecessary here to specify, as they will be detailed in the chapter already referred to.

3. With regard to the procuring of good seed, considerable difficulty has prevailed, from the fraud practised by mercenary individuals, who often mix seeds of nearly the same size, in order to save time and trouble in sowing them. Speaking of *separated grass-seeds*, Mr. Young observes, that he cannot advise a young farmer to pay much attention to this object, unless he proceeds on very sure grounds, by forming a contract for the sale of the seeds at a good price, before he commences his operations. This method he has resorted to, and has found it cheaper to procure the seeds, by having them gathered by women and children, by hand, than to raise them himself, under the determination to have them perfectly free from all mixture. He states (Farm. Cal. p. 242,) that he has had large quantities of cock's-foot and tall oat-grass gathered at four shillings per bushel, and the crested dog's-tail at a shilling a pound; and has thus laid down many scores of acres, having found them cheaper at these prices than when they were raised in drills with great attention.* Where, however, a farmer is desirous of obtaining pure seed for his pastures and meadows, and can command the necessary time for raising a supply of seed for future use, he may profitably avail himself of the following directions, given for this purpose by the late Mr. Curtis ("Practical Observations on the British Grasses," p. 31).

"If a piece of ground can be had, that is neither very moist nor very dry, it will answer for several sorts of seeds; they may then be sown on one spot; but if such a piece cannot be obtained, they must be sown on separate spots, according to their respective qualities, no matter whether in a garden, a nursery, or a field, provided it be well secured

* As, however, it may sometimes happen, that a young farmer may not be able to procure seeds in this way, and consequently is reduced to the necessity of purchasing seeds from the shops; we cannot, on the present occasion, in justice, omit to mention Messrs. Gibbs and Co. seedsmen to the Board of Agriculture, whose indefatigable efforts to procure the best seeds of every description, are, in every respect, worthy of the patronage they have obtained.

and clean. Dig up the ground, level and rake it, then sow each kind of seed thinly in a separate row, each row about a foot apart, and cover them over lightly with the earth: the latter end of August or beginning of September will be the most proper time for this business. If the weather be not uncommonly dry, the seeds will quickly vegetate, and the only attention they will require will be to be carefully weeded. In about a fortnight from their coming up, such of the plants as grow thickly together may be thinned, and those which are taken up transplanted, so as to make more rows of the same grass.

“If the winter should be very severe, though natives, as seedlings, they may receive injury; therefore it will not be amiss to protect them with mats, fern, or by some other contrivance.

“Advantage should be taken of the first dry weather in the spring, to roll or tread them down, in order to fasten their roots in the earth, which the frost generally loosens: care must still be taken to keep them perfectly clear from weeds. As the spring advances, many of them will throw up their flowering stems, and some of them will continue to do so all the summer. As the seed in each spike or panicle ripens, it must be very carefully gathered, and sown in the autumn, at which time the roots of the original plants, which will now bear separating, should be divided and transplanted, so as to form more rows; the roots of the smooth-stalked meadow-grass, in particular, creeping like couch-grass, may readily be increased in this way; and thus, by degrees, a large plantation of these grasses may be formed, and much seed collected.”

In laying down lands to grass, the most important primary object is duly to prepare them for the reception of the seed. Hence the soil ought previously to be brought into the highest possible degree of fertility; for, though land may be too rich for the production of corn, and of such crops as are cultivated for the seed, it is quite otherwise in the case of grass or other crops, where the object in view is the largeness and luxuriance of the plants themselves; as it is in the cultivation of all plants intended for *feeding cattle*. In such case, indeed, the richness of the soil is a most important consideration; because, the

richer it is made, the more abundant crops will it produce, and consequently will support a larger stock of cattle; which making much dung, that is returned again to the land, in order to keep up its fertility; whereas effects directly contrary must result from laying down to grass poor land, or such as has been impoverished by successive exhausting crops. Further, on account of the minuteness of the seeds, and the (generally) fibrous nature of the roots of grass-plants, it is essentially requisite to the formation of a good meadow, that the ground be previously brought into the highest possible degree of pulverization; otherwise the irregularity of the surface will not only occasion an irregularity in the produce of grass, but this will be liable to be materially damaged by excessive droughts before it can have extended its roots, or become firmly settled in the land. This preparatory pulverization of grass-land may be effected in various ways, according to the nature of the different soils. Thus, in light soils, frequent ploughing and harrowing, together with the previous rearing of turnips, potatoes, tares, and other green fallow crops, which by the shade they afford, as well as the culture they require during their growth, are calculated to reduce the soil into a friable state. And Mr. Young is of opinion, that the preparation of land for grass either by a fallow or by winter tares sown very early, and mown in June for soiling, (which will give nearly two months in the very heat of summer for tillage), is one of the most effective for cleaning land that can be adopted.* Heavy and stiff soils may be prepared for grass crops by repeated ploughing before winter, and leaving them exposed to the action of the frost during that season, together with frequent harrowing, and sometimes rolling in the ensuing spring; and likewise the introduction of cabbage, clover, rape, beans, or other vegetable crops, which have a power, in consequence of the peculiar formation of their roots, to loosen such compact soils, and reduce them into a fine condition. Besides, all obstruction to the scythe, such as ant-hills,

* In a communication to the intelligent author of the Agricultural Survey of the county of Durham, Sir John Eden states that, "from repeated experience, he is fully satisfied that the best mode of laying down land to permanent grass, is by early ploughing in autumn, and cleaning the next summer, and then to sow with new hay-seeds, white clover, and rib-grass, about the latter end of July." He tried this upwards of fifty years since, and practised it ever since with success. Bailey's Report of Durham, p. 181.

mole-hills,* &c. should be carefully removed, and the land manured. The manures proper for this purpose having been already stated in this chapter, (see pp. 346—390 *supra*), it only remains to add, in this place, that the proper season for this purpose is in February, and again after the grass has been mown ;

* Some of these obstructions have been already noticed (p. 304 and following): in addition to the method of destroying ant-hills there stated, we would recommend the following to the attention of our readers, from Mr. Marshall's "Rural Economy of Norfolk," Vol. i. The process recorded by him is as follows: "With a heart-shaped spade, or shovel, the hills are cut up in irregular lumps, of from ten to fifteen inches in diameter, and from two to six inches thick. The grass sides of these are turned downwards, until the mould side is perfectly dry, when the former is exposed to the air, until the heaps are sufficiently dry to burn. A fire is then kindled by means of brushwood, and kept smothering, by gradually laying on the sods, or lumps, as the fire breaks out, until ten, fifteen, or twenty loads of ashes are raised in one heap. This," Mr. M. observes, "is a cheap way of raising manure, while at the same time it removes a nuisance; and no man, having such an opportunity in his power, ought to neglect at least the making of an experiment. Ashes are, on some soils, an excellent manure; and perhaps, generally ashes thus raised would be found highly advantageous, as a basis, or *bottoming*, for farm-yards and dung-hills."

With regard to the removal of *mole-hills*, various practices are in use; but the most effectual is that derived from the experience of a successful mole-catcher, and communicated to the public by the late Dr. Darwin, in his "Phytologia." This man commenced his operations before sun-rising, when he carefully watched their situation; and, frequently observing the motion of the earth above their walks, he struck a spade into the ground behind them, cut off their retreat, and then dug them up. As moles usually place their nests at a greater depth in the ground than their common habitations lie, and thus form an elevation, or mole-hill, the next step is to destroy these nests by the spade; after which the frequented paths are to be distinguished from the bye-roads, for the purpose of setting subterraneous traps. This object may be effected by marking every *new* mole-hill with a slight pressure of the foot, and observing the next day whether a mole has passed over it, and destroyed such mark; and this operation should be repeated two or three mornings successively, but without making the pressure so deep as to alarm the animal, and occasion another passage to be opened. Now the traps are to be set in the frequented paths, and should be made of a hollow, wooden semi-cylinder, each end of which should be furnished with grooved rings, containing two nooses of horse-hair, that are loosely fastened in the centre by means of a peg, and are stretched above the surface of the ground by a bent stick, or strong hoop. As soon as the mole passes half way through one of these nooses, and removes the central peg in its course, the hoop or bent stick, rises in consequence of its elasticity, and of course strangles the mole. The simplicity of this mode of destroying mole-hills and moles, recommends itself to general adoption; as those whose grounds are thus infested may easily extirpate them, or teach the art to their labourers.

but, if the application of manure to grass-lands be omitted after mowing, it ought on no account whatever to be deferred later than October.

Seeds. These Mr. Young directs to be varied according to the annexed table.

<i>Clay.</i>	<i>Loam.</i>	<i>Sand.</i>	<i>Chalk.</i>	<i>Peat.</i>
Cow grass	White Clover	White Clover	Yarrow	White Clover
Cock's-foot	Ray, or Rye-	Ray	Burnet	Dog's-tail
Dog's-tail	grass	Yorksh. White	Trefoil	Cock's-foot
Fescue	Yorksh. White	Yarrow	White Clover	Rib
Oat-grass	Fescue	Burnet	Saintfoin	Yorksh. White
Trefoil	Fox-tail	Trefoil		Ray
Yorksh. White	Dog's-tail	Rib		Fox-tail
Timothy	Poa			Fescue
	Timothy			Timothy
	Yarrow			
	Lucerne			

In regard to the quantity per acre of these plants, Mr. Y. remarks, that the proportion must necessarily depend on the means of procuring them. In situations where women and children are fully occupied, it may be difficult to obtain large quantities gathered by hand; and, in such cases, the farmer must be content with what can be purchased. The crested dog's-tail, indeed, may be so generally procured in this way, that he cannot but suppose it to be in a good measure at command.* Without adverting to this point, however, he thinks that, from the lands which he has laid down to grass to a considerable extent, and in which he has largely used every one of the plants above enumerated, except the poa, or meadow-grass, the following quantities may be safely recommended. These proportions are also recommended by other eminent cultivators, whose names will be duly specified.

I. CLAY.

<i>Seeds.</i>	<i>Substitutes.</i>
Cow-grass.....5 lbs.	Yorkshire white.....2 bush.
Trefoil 5 lbs.	Timothy 4 lbs.
Dog's-tail 10 lbs.	Ditto 4 lbs. or Yorkshire white
Fescue } 1 bush.	1 bush.†
Fox-tail }	

* Farmer's Calendar, p. 448.

† Rev. A. Young, son of the veteran agriculturist, whose labours are so often noticed in this work, in "Communications to the Board of Agriculture, Vol. iii, p. 150.

II. LOAM.

*Seeds.**Substitutes.*

White Clover.....5 lbs.	{ Ray.....1 peck.
Dog's-tail.....10 lbs.	{ Rib grass.....4 lbs.
Ray 1 peck,	
Fescue 3 pecks,	Yorkshire white 2 pecks,
Fox-tail..... 3 ditto,	Timothy 4 lbs.
Yarrow..... 2 ditto.	Cow-grass.....5 lbs.

On loams, that are on a substratum of *stone-brash*, (of which description are almost the whole of the Cotswold-Hills, and great part of the counties of Gloucester, Somerset, Warwick, and Wilts), Mr. Davis * recommends the following quantities to be sown per acre, after marling in July, viz.

Ray-grass.....	1 bushel,
Marl, or cow-grass	10 lbs.
White, or Dutch clover	3 lbs.
Trefoil, or hop-clover	1 lb.

All dry soils, however, (and it should be recollected that *loam* includes every species of soil except clay, peat, and sand), Sir John Sinclair† thinks, may have from two to four pounds of hop or yellow clover, in addition to four pounds of white, and from four to six pounds of marl-grass, or perennial clover, per acre. And he states the following plan to be recommended by Mr. Bridge, a respectable farmer in Dorsetshire, for laying down lands for permanent pasture, viz. To sow marl or cow-grass, hop or yellow clover, and white clover, in the proportion of from six to seven pounds of each, with one bushel of the best Devonshire rye-grass; by which means “there is a perpetual feed for five or six years.” The hop-clover and rye flourish early in the spring; the marl-grass is in perfection in July, when the other goes off; and the white clover is in perfection in August, continuing during the remainder of the season. In some meadows of very rich soil, it is suggested, that lucerne ought to be preferred; and it would be of infinite importance to ascertain the extent to which the culture of that plant could be carried.

* “Communications,” Vol. iii. p. 90. † Ib. p. 10.

III. SAND.

*Seeds.**Substitutes.*

White Clover.....	7 lbs.	
Trefoil	5 lbs.	
Burnet	6 lbs.	
Ray	1 peck,	{ Ray.....1 peck Rib.....4 lbs.
Yarrow	1 bushel.	

Mr. Greenall, however, recommends the following proportions for soils of the like nature, which he has always found to answer, viz. white clover and trefoil, of each five pounds; ray-grass and the best grass seeds (the last collected as they have fallen from the hay) of each one bushel to the statute acre.*

IV. CHALK.

*Seeds.**Substitutes.*

Burnet	10 lbs.	
Trefoil	5 lbs.	
White clover	5 lbs.	
Yarrow	1 bushel.	Ray.....1 bushel.†

For these soils, Mr. Boys of Betshanger, in Kent, advises four bushels of grass-seed, from an old pasture, to be sown with eight pounds of rib-grass; white clover and cow-grass seeds, of each four pounds; and a similar quantity of yellow trefoil; which proportions will be sufficient for an acre of land.

V. PEATY SOILS.‡

*Seeds.**Substitutes.*

White clover.....	10 lbs.		
Dog's-tail	10 lbs.	Yorkshire white.....6 pecks.	
Ray	1 peck.		
Fox-tail	2 pecks.	Rib-grass.....5 lbs.	
Fescue	2 ditto.	Cow-grass	4 lbs.
Timothy	1 peck.		

Without specifying any particular soils, Dr. Wilkinson, an experienced agriculturist of Enfield, Middlesex, recommends the use of trefoil and rib-grass, of each four pounds, white clover twelve pounds, and broad clover four pounds; supposing

* "Communications," p. 283. † Young, *ibid.* p. 151. ‡ *Ibid.* Vol. iii. p. 151.

the grass-seeds to be thrown in with barley or oats. The same gentleman also remarks, that it is of consequence that a full quantity of seeds be thrown in.*

Although the preceding assortment of seeds, adapted to the nature of different soils, may appear sufficiently full and diversified, so as to render any further details on this head unnecessary; yet, as it is a matter of fundamental importance to have seed apportioned for every possible variety of soils (particularly in returning tillage-land back again to grass), the following additional remarks, by Mr. Tollet on this subject will, by their intrinsic merit, forcibly arrest the attention of every intelligent farmer.

Conceiving the degress of moisture or dryness, rather than the component materials of the land, to be the leading characters that should determine us in the choice of seeds for future pasture, Mr. T. accordingly divides the different soils into the four following classes, and specifies the relative proportions of seed best calculated in his opinion for each acre.†

I. UPLANDS,

Or such dry and light Soils as are adapted to the Growth of Turnips,

Smooth-stalked poa, or	Vernal-grass.....1 quart,
meadow-grass.....6 quarts,	Marl-grass 3 quarts,
Ray-grass 4 ditto,	White clover 2 ditto,
Crested dog's-tail 6 ditto,	Rib-grass 2 ditto,
Yellow oat-grass.....4 ditto,	Yarrow 2 ditto,
Cock's-foot dactylis ..2 ditto,	

to be sown with barley.

For good sandy loams, two quarts of meadow-fescue may be added.

On calcareous, hilly soils, saintfoin should be substituted for the four last plants; and, as the soil approaches a pure chalk, Mr. T. directs the saintfoin to be gradually increased to the exclusion of the rest.

II. MIDLANDS,

Or such Soils as are too moist for the Turnip Husbandry, are, by Mr. Tollet, subdivided into the three following classes, for which he proposes the respective quantities of seed annexed.

* Young in "Communications," Vol. iii. p. 243. † Ibid p. 439.

1st CLASS includes the driest in point of soil and situation, of which description are those clayey loams that approach to the nature of turnip-land.

Meadow-fescue.....8 quarts,	Vernal-grass.....1 quart.
Smooth-stalked poa..6 ditto,	Marl-grass 3 quarts,
Ray-grass 4 ditto,	White clover 2 ditto,
Crested dog's-tail 4 ditto,	Rib-grass 4 ditto,
Cock's-foot dactylis ..2 ditto,	Yarrow 2 ditto.

2d CLASS comprises such lands as from their situation are higher, though the soil be retentive of moisture.

Meadow fescue.....6 quarts,	Vernal-grass.....1 quart,
Meadow fox-tail 4 ditto,	Marl-grass 3 quarts,
Smooth-stalked poa..4 ditto,	White clover 2 ditto,
Ray-grass 2 ditto,	Rib-grass 4 ditto,
Crested dog's-tail 2 ditto,*	Yarrow 2 ditto.
Cock's-foot dactylis ..2 ditto,	

3d CLASS contains those lands which from soil and situation, though sound, are of a moister nature.

Meadow fox-tail 6 quarts,	Vernal-grass.....1 quart,
Rough-stalked poa ..6 ditto,	Marl-grass 3 quarts,
Meadow fescue 6 ditto,	White clover 2 ditto,
Smooth-stalked poa ..4 ditto,	Rib-grass 2 ditto,
Ray-grass 2 ditto,	Yarrow.....2 ditto.

It is, however, impossible, adds Mr. T., to give general rules for every variety of soil and situation: a little practice will regulate the proper habitation of each plant. By cultivating them, the farmer will know the meadow fox-tail, the meadow fescue, and the poas, as well as he now knows the ray-grass; and, by observing where they grow naturally on his land; he will have a certain indication of the soil best suited to them.

III. LOWLANDS, or MEADOWS.

Under this class Mr. Tollet comprises such lands as are occasionally overflowed by rivers or brooks, and from which we derive our greatest crops of hay; because "their natural moisture is propitious to the growth of our best grasses, and the

* We apprehend this is the quantity intended, though none is specified in Mr. Tollet's memoir.

sediment of the inundations operates as a constant manure : but the turf of these, as well as of other pastures, is filled with rubbish. If, therefore, it is intended to clean the meadow of its improper and noxious plants, the turf early in the spring should be lightly ploughed up, and afterwards cross-ploughed and dragged and harrowed in dry weather, till the whole of the plants are killed, and till the ground be perfectly fine and level. With the first showers in August, it should be sown with the following grasses :

Meadow fox-tail 2 pecks	Vernal grass 1 quart,
Meadow fescue 2 ditto,	White clover 2 ditto
Rough-stalked poa . . 2 ditto,	Marl-grass 2 ditto,
Ray-grass 2 ditto,	Rib-grass 2 ditto.

“ The foregoing mixture is adapted to the soundest meadow land, where the floods are soon drained off.

“ Where the water lies longer, the composition should be as follows :

Rough-stalked poa 2 pecks,	Flote fox-tail 3 quarts,
Meadow fox-tail 2 ditto,	Flote fescue 4 ditto.
Meadow fescue 2 ditto,	

“ And for situations still more wet, the following :

Rough-stalked poa 2 pecks,	Flote fox-tail 1 peck,
Meadow fox-tail 2 ditto,	Flote fescue 1 ditto.”

IV. FENS.

Under this head are included such unsound lands as have, by a certain degree of draining, become capable of some cultivation ; whether they are properly fens, or morasses, or peat-bogs.

In the first stage of the improvement of fenny lands and morasses, the water poa is the only plant proper to be cultivated, the great utility of which, in its spontaneous growth, will be shown in the next chapter. Mr. Tollet has never heard of its having been cultivated from seed ; but there is every reason to conclude, that, in situations resembling its native haunts, it might be introduced to much advantage. He directs, that the land intended to be sowed with it should, in April, May, or June, as the weather may permit, be breast-ploughed,

and the turf burned. If the land under a favourable season will bear the plough, it should afterwards be ploughed and cross-ploughed, well dragged and harrowed, and the seed sown in August, at the rate of two bushels per acre. Should the land not admit the plough, it would be better to breast-plough and burn it in the middle of summer, to sow the seed in August, and to cover it as well as can, in that case, be done, by men drawing light harrows over it, and afterwards bush-harrowing it in the same manner. Upon land a degree more sound than the former, and subject to less violent inundations, the flote fox-tail and the flote fescue will be the proper plants.

The land should be prepared for them as before directed, and they should be sown in August, at the rate of one bushel of seed of each per acre.

On lands still more sound, approaching to the moister meadows, Mr. T. would recommend the rough-stalked poa to be added, sowing equal proportions of each, at the rate, in the whole, of two bushels per acre. However, on lands like these, a still more eligible mode of cultivating the plants suited to them, would be to set the young plants themselves at the distance of eight inches from each other. The land should be prepared by breast-ploughing, burning, &c. as before. The young plants having been raised from seed sown the preceding August, should be taken up, divided, and set at the distance before directed, as soon after the ground is prepared by the destruction of weeds, &c. as the season will permit, taking care that the ground be sufficiently moist to insure their growth. The first rains after midsummer will probably afford an eligible opportunity. The distance between the plants will enable the hoe to be used to keep them free from weeds; this should be attended to the first autumn and the following spring.* The process, he remarks, may be attended with some expense; but it would occur but once, and it would be creating a valuable pasture, probably for ages.

Peat bogs, or mosses, in favourable situations, admit of very great improvement. These lands, consisting almost entirely of decayed vegetable matter, require the aid of some alkaline substance to bring that matter into action; by the help of which

* Mr. Tollet has no doubt but this method might be extended with advantage to the sounder meadows.

they are capable of being brought to a high state of fertility. When thoroughly drained, the first step should be to pare and burn the peat in considerable quantities, and it should be set with potatoes. This, after the draining, will give the land some time to settle. As soon as it will bear the team, if marl lie contiguous, the first opportunity should be taken of giving it a plentiful covering: with a light ploughing, the ground should be sowed with oats and proper grass-seeds. The following winter, or early in the spring, a good top-dressing of marl should be applied to the turf; and thus lands of this nature may be turned into tolerably good pastures. If they could be irrigated, their value would be greatly increased; and if the water carried over them were impregnated with calcareous matter, they would become an artificial imitation of the famous Orcheston meadow, and rival it in produce. Next to marl, lime is the proper agent to resort to.* But it is recommended that this be always mixed with some sort of soil, in the proportion of about one-third lime to two-thirds soil. The best substance for this mixture is clay; but Mr. Tollet would even use keen gravel rather than not mix it, as it would tend to give a firmness and soundness to the surface.

The different degrees of moisture should regulate the choice of the plants as before directed. Where the peat land is made thoroughly sound and marled, the plants recommended for meadows are proper to be cultivated thereon, in all cases adding a quart of the sweet-scented vernal-grass to the composition.

In moister situations, equal quantities of rough-stalked poa, flote fox-tail, and flote fescue, with two quarts of vernal-grass, would be suitable; and in situations still more wet, a bushel of flote fox-tail, and the like quantity of flote-fescue, with two quarts of vernal-grass, would be the proper composition.

An uncommon instance of superior management in soils of this description occurs in Mr. Young's "Annals of Agriculture," which he justly accounts, in common with many excellent cultivators, one of the most original discoveries he has any where met with, in the improvement of grass-land.

"Mr. Salter, of Winberg, near Dereham, upon his large

* Where chalk is to be had, it will answer every purpose of lime.

farm of above 800 acres, found 3 or 400 acres of old meadows entirely poisoned by springs, which, from every sort of impediment that neglect could cause, had formed bogs and moory bottoms, famous for rotting sheep and miring cows; with blackthorns and other rubbish spread over large tracts. His first operations were to grub and clear the land, and open all ditches to the depth of four or five feet, and to cut open drains in almost every direction for laying them dry; burning the earth and spreading the ashes on the ground: so far, all was no more than common good husbandry. But he applied a thought entirely his own: as he found that the flinty gravel, marl, and other earths, but especially the gravel, were very beneficial to the herbage, he thought of sowing winter tares and white clover upon the places wherever any earth was spread, or any other operation had laid bare the surface, harrowing in those seeds. I had the pleasure of seeing several of these crops growing; the success has been uncommonly great; for the land thus sown not only has given large and very profitable crops of hay, but has also received a rapid improvement in the herbage; the cover and shade of the tares, so beneficial to all land, mellowed the surface, and seemed to draw up, as well as protect, such of the old plants as received improvement from the manure, and exhibited a much superior fleece of grass to any spots where this singular management had not taken place. So that nothing can be clearer, on viewing this large tract of meadow, than the superiority of the improvement resulting from the growth of the tares: the effect of the manure is much accelerated and rendered greater. The idea is certainly applicable to many of the grass-lands of the kingdom, especially such as are improving by the addition of chalk, marl, clay, loam, sand, or gravel; forty loads an acre of any of these bodies will much improve coarse, or wet, or moory grass-lands; and then to add tares secures an immediate profit, and makes the manure work much sooner and more powerfully. He sows some so late as the middle of May. An idea here strikes me, which I shall venture to add; that if I was to scarify any mossy, hide-bound, or poor pastures, &c. it should be with a drill scarifier, drilling in winter tares by every tooth of the scarifier, and I have no doubt but the tares would take well, and effect a considerable improvement, even without manuring. Mr. Salter has practised the tare husbandry on meadows for ten years; but his first,

beginning was seventeen years ago, at Ellingham: the cockchafer-grubs had destroyed a part of a meadow; he harrowed in tares and seeds, and the success was great."

Beside these rotations, or courses of seeds for grass-lands, there are several others which have been practised by intelligent farmers, and are deserving of notice.

The following proportions were sown a few years since by the Earl of Darlington:

White or Dutch clover	17 lbs.
Clean hay-seeds	14 bushels.
Rib-grass }	1½ lbs.
Trefoil }	

By which means (the soil being previously ploughed very fine and made perfectly level) the land was speedily covered with a thick and excellent herbage. The only exceptionable thing in this practice is, the quantity of seed, which is certainly too large for a statute acre.

Mr. Dalton's (of Sleningford) mode of laying down land to grass,* is to make the ground perfectly smooth and level, and then sow upon every acre the following seeds, viz.

Hay-seeds	6 bushels.
Rib-grass	12 lbs.
White or Dutch clover	8 lbs.
Burnet	5 lbs.

He manures it well with a compost of earth, dung, and ashes, thoroughly mixed together; and folds his sheep upon it, two nights in the same place, which practice answered uncommonly well. The proportion of seed, however, is still too great, though in other respects his management be excellent.

In the laying down of land for the purpose of forming a good meadow, greatly superior to the generality of pastures, the late Mr. Curtis recommends the six following grasses, and two species of clover, to be mixed in these proportions.

* Young's Northern Tour.

Meadow fescue-grass, one pint	Crested dog's-tail, one fourth of a pint
Meadow fox-tail grass, ditto	Sweet-scented spring-grass, ditto
Rough-stalked meadow-grass, half a pint	White or Dutch clover, half a pint
Smooth-stalked meadow-grass, do.	Common or red clover, ditto

(For wet land, the crested dog's-tail and smooth-stalked meadow, Mr. C. says, may be omitted, especially the former.)

These are to be mixed together, and about three bushels of them sown on an acre, in rows, in order that they may be more conveniently hoed, in consequence of which they will vegetate with increased luxuriance.* Towards the end of August, or early in September, Mr. C. states, that it will be necessary to weed and thin the grasses occasionally, and also to roll them in the spring; by which means the roots, that may have been raised by the frost, will be pressed into the ground. For *moist* lands, he conceives the meadow fox-tail and meadow fescue grasses to be best adapted; as the smooth-stalked meadow and crested dog's-tail are to dry pastures; while the sweet-scented vernal grass and meadow-fescue will suit land that is either moist or moderately dry. These plants are asserted to form a good turf speedily; being, for the most part, vigorous perennials, they are not liable to be overpowered by the spontaneous growth of coarse vegetables indigenous to such soils; and, if the land be previously cleansed from all weeds and noxious plants, the combination of grasses above specified will, in the course of two years, produce a most excellent method.

Mr. Salisbury, the able successor of Mr. Curtis, has improved upon his practice, and has succeeded in forming permanent meadows according to the following method, for which he was honoured with the silver medal of the Society for the Encouragement of Arts, &c. To accomplish this object, he observes, three things are necessary, viz. to clean the land, to procure good and perfect seeds adapted to the nature of the soil, and to keep the crop clean by eradicating all the weeds till the grasses have grown sufficiently to prevent the introduction of other plants. The two first of these requisites having been already discussed, we proceed to notice the result of Mr. Salisbury's successful practice.

* Practical Observations on British Grasses, 8vo. p. 33.

Grass seeds, he states, may be sown with equal advantage both in spring and autumn: in one particular instance, the land was sown towards the end of August; and the seed employed was, one bushel of meadow fescue, and one bushel of meadow fox-tail grass, with a mixture of 15 lbs. of white clover and trefoil. The land was previously cleaned as far as possible with the plough and harrow, and the seeds were sown and covered in the usual way. In the following October, a prodigious crop of annual weeds of many kinds had grown up, and were in bloom, covering the ground and the sown grasses: the whole of these weeds, being then mown and carried off the land, were at once destroyed; and, while their stalks and roots were decaying, the sown grasses were gaining strength, and the few perennial weeds which were among them, were drawn by hand in fine weather. The whole was repeatedly rolled, to prevent the worms and frosts from throwing the plants out of the ground; and, in the following year, there was a remarkably fine field of grass.*

Where land is intended chiefly for sheep pasture, it has been recommended to sow three sorts of grasses, in order to obtain the benefit of successive growth. Agreeably to this practice, Mr. Parkinson, an experienced farmer, sows four bushels of ray-grass, or red daniel seed, ten pounds of trefoil (more correctly common clover) seed, and ten pounds of white clover. Thus, he thinks, the ray-grass should be fed off early, before the white clover appears, and while the trefoil or common clover is just springing forth; so that when the ray-grass is eaten down, the common clover will shoot up, and afford excellent food, which will be succeeded by the white clover: and, when this last is eaten, the ray-grass will again vegetate, and afford a supply of food during the winter months. From this practice, Mr. Parkinson infers, that one-third more in number of sheep may be sustained than can be effected by any other method.

Generally speaking, however, where the lands thus laid down to grass are intended for sheep, it is not an object of very great moment to sow only the finer sorts of grass, because close-feeding will, after the first year, make any of the coarser kinds fine, sweet, and productive. To this circumstance of close-feeding, that is, preventing the seeds from rising, the Wiltshire

* Transactions of the Society of Arts, &c. Vol. xxvii, p. 67—72.

downs are indebted for the *sweetness of their bite*; which, Mr. Davis has judiciously remarked, depends more on its being kept close and being eaten as fast as it shoots, than on any peculiar good quality of the grass itself; for there are many downs that, when closely fed, appear to be a very sweet pasture; but which, if suffered to run one or two years, without being fully stocked, will become so coarse that sheep will almost prefer starving to the eating of such grass.* And Mr. Young, jun. has had two hundred acres of land, under his management, laid down chiefly for sheep, the fields of which he has stocked so early in the spring, and so thickly, as just to keep down the seed stems; by which management the cock's-foot, oat-grass, and Yorkshire white, have proved sweet-feeding grasses, that were not at all rejected even where the flock had a choice.† But it should seem that where a field has been long pastured in this way with sheep, and closely fed, it ought not to be converted into a meadow in order to be mown for hay; because the plants, by being constantly cropped down, acquire a dwarfish habit, however quick their growth may be in that early stage.

With regard to the time and method proper for sowing grass-seeds, there is a difference of opinion; not only as to the season for depositing the seeds in the ground (which is either in the spring, in conjunction with grain-crops, or towards the end of summer, or in August, where the soil has been previously prepared by means of green or other fallows), but also as to the propriety or necessity of sowing them with or without other vegetable crops.

Not to enter into a discussion of the arguments produced in favour of these practices, we state the following results of actual experiments by intelligent agriculturists. Mr. Lyster, of Bawtrej, found, on comparing the *vernal* and *autumnal* sowing, that the latter was much the better. Mr. Dickson, of Belford, made a comparative experiment in the spring; four acres with grasses only, on peas and buck-wheat ploughed in the preceding autumn; five acres with barley; and five with the seeds alone, without either corn or manure. The two divisions that were sown alone were over-run with chickweed, and

* Agricultural Survey of Wiltshire, p. 18.

† "Communications to the Board of Agriculture," Vol. iii, p. 151.

would have been choaked, if this had not been consumed by a dairy of cows: from that time, for a period of seven years, no difference was perceptible between the three divisions. From the extensive experiments of the Earl of Holderness, it appears, that seeds answered best when sown alone. The fact, however, is, as an intelligent agriculturist has remarked, that grass-seeds will succeed almost equally well in either method; though, if a preference were given, it should be to August sowing without corn; but the success which he has witnessed in both seasons, does not allow any positive opinion. Moors and mountains form an exception; in such situations, snows fall too early to hazard such sowings, which ought, therefore, never to take place in autumn, or be ventured later than the first week in August. But the better season is the spring, with oats, either for soiling or hay,* though, on *strong land*, that sort of barley which runs least to straw, and is earliest ripe, is far preferable to oats, on account of the tendency in barley to loosen the texture of the ground whereon it grows, and consequently favour and accelerate the growth of the grass;† and, for the same reason, on yet stronger land, grass-seeds may be advantageously sown with thin crops of beans.

Having already adverted to the necessity of bringing grass-lands into a fine state, we shall at present only remark, that where a vernal sowing takes place with a crop of corn, the tillage ought to be given with more than common attention. Hence the land should be ploughed thrice, and afterwards harrowed, or scuffled and rolled, according to the nature of the soil; for, whatever that may be, the ground should be well reduced for grass-seeds. This attention, however, is not so necessary for an August sowing; because the time and season afford so ample an opportunity to prepare, that, if the first earth had been given in autumn, the most negligent farmer can scarcely find any other difficulty than what arises from an uncommonly wet season.‡ But, in order to complete the formation of a good meadow, it is necessary that the seed be sown as early as possible after the soil has been ploughed, and with as much re-

* Rev. A. Young, in "Communications to the Board of Agriculture," Vol. iii. p. 142.

† Rev. Edmund Cartwright, *ibid.* p. 184.

‡ Young, in "Communications," Vol. iii. p. 143.

gularity and uniformity as is practicable. Hence it is obviously necessary that an expert seedsman be employed, and also to guard against the bad practice of seedsmen, who are apt to mix seeds which are nearly of the same size, in order to have the fewer casts. Five pounds weight of any clover, &c. cannot be divided and sown at two casts, but ten pounds may and ought to be divided; and, if the quantity be larger, it is better sown at three. For all small seeds, Mr. Young jun. has suggested, that the delivery may be best effected by means of the Norfolk *turnip-trough*, which has been recently adapted to clover and ray-grass,* and it is highly probable, that Mr. Knight's and the Rev. Mr. Munnings's *turnip-drills* (which have been already described, pp. 254—256) may be usefully employed in, or adapted to, putting in grass-seeds. As uniformity of delivery is a point of the greatest consequence, the lighter sorts of grass-seed should never be sown in windy weather, or in wet seasons; when the least degree of poaching might ensue. All grass-seeds should be covered in, by passing a very fine light pair of harrows once over them; and, in the case of light or porous soils, they may be advantageously rolled.

The successive or autumnal management is a point of considerable consequence, and this in proportion to the moisture of the soil. All trampling by cattle and horses is very pernicious; for the soil, after a grain crop, or after the tillage of a fallow, is very "tender," and affected by every impression. Every sort of stock, therefore, should be carefully excluded throughout the following autumn and winter; for the profit resulting from the bad practice of too early feed is very small, and not to be compared with that derived from it as a *spring* pasturage, for ewes and lambs. Dr. Wilkinson advises manuring at this time; though this part of the management will not be found material, provided the system of preparation already noticed be attended to.

With regard to the preceding management of new lays, or grass-lands, there is a great difference of opinion, some contending that the new lay should be pastured with sheep; others, by cattle; others, that it should be mown for hay; and others again, that it should be seeded.

* Young, in "Communications," Vol. iii p. 154.

The sweetness of pastures on many sheep-downs, we have already observed, depends on the closeness of the feeding; hence many intelligent cultivators, in the North Riding of Yorkshire, feed their new lays with sheep for the first two years.* And where ray-grass and white or Dutch clover are intended to remain for some years, it has been found profitable to feed them the first year with sheep, which thicken, close, and render them more permanent.†

The *mowing* of new lays is a beneficial practice, particularly in moist meadows, the soil of which will of course suffer by poaching; in this case, however, it should be early cut, as nothing is more pernicious to new layers, than that the grass should run to seed. From an accurate comparative experiment, by Dr. Wilkinson, of sheep-feeding with mowing, the superiority of the former was indeed very great; hence it should seem to be the most profitable management to feed a new lay with sheep for the first two or three years, beyond which time there will be no necessity to continue it any longer; though the Rev. Mr. Young states, that he has had some fields under his care, which succeeded well in feeding four, five, and even six years. In general, he observes, it may be laid down as a rule, that the more land is sheep-fed the more it will be improved, especially if, at any future time, it should be again ploughed for corn; but, in this system of sheep-feeding, the unnecessary and impoverishing practice of removing sheep to be folded in other places, must on no account be attempted.

If the preceding hints be duly regarded, little apprehension can be entertained of a failure; though such an event may possibly take place in extremely unfavourable seasons. It can, however, scarcely happen to more than one or two sorts of seed; and in this, or indeed in any case of failure, fresh seeds should be sown in moist weather, during the spring; and it will be advisable to tread them in by turning a flock of sheep into the field, if practicable; but, if this cannot be done, Mr. Young is of opinion, that it should take its chance, for a roller will not so well effect it, and a hammer cannot enter without injury. If a very large fold, five or six yards to a sheep, be

* Agricultural Report of the North Riding of Yorkshire, p. 48.

† Corrected Agricultural Report of Perthshire, 8vo.

run over a field, once in a place, and the seeds be sown before the sheep are permitted to enter, success will be almost certain.

Should, however, a total failure, from any unforeseen circumstance, take place, he recommends, in fields that were sown in the spring, to clear the grain as early as possible; and, ploughing once, to harrow in fresh seeds immediately. These will succeed very well, if they be got in during the month of August—the sooner the better—and in this case the land ought to be very well rolled in the month of October, in a dry season. If the failure happen on land sown in August, he advises to give the land three *earths*, or ploughings, in dry weather in the spring, and to re-sow grass-seeds with buck wheat in May; of which he remarks, that though it be not a crop calculated for clays and wet loams, yet it sometimes answers in dry summers; and in wet seasons, though it will give little seed, yet it may be mown, while in blossom, for soiling cows.*

If the land be laid down agreeably to the hints already given, manure will not be found *essential*, notwithstanding it will at all times be *beneficial*. In addition, therefore, to the remarks already stated on the subject of manuring grass-lands, we have to observe, that, if manure be applied the first year, the best time for this purpose is in August or September, being then a year old, when a moderate dressing will greatly contribute to promote the thickening of the herbage. But, on soils that are rather unfavourable to grass, and on which the success is at all doubtful (if the application of manure can only be once made), it would be better delayed to the period when new lays are apt to fall off, that is in August, in the third year; but, if the grass be mown, the best time for manuring land will be immediately after clearing off the hay.

Early in March, the grass of old-watered meadows is, in general, sufficiently forward to receive sheep, which are accordingly fed on it during that season; and to those farmers or graziers, who reserve water-meadows for the purpose of breeding or fattening sheep, the grass thus produced is almost invaluable, on account of the scarcity of green feed which then usually prevails. In order to afford an abundant pas-

* Rev. A. Young, in "Communications to the Board of Agriculture," Vol. iii. pp. 156, 157.

turage to any kind of farming stock (for, though the general practice is to admit only sheep into water-meadows, yet, upon good, sound gravel, Mr. A. Young sen. thinks, *any heavier* stock may be allowed to enter them,) the water should, according to Mr. Wright, be taken off for nearly a week, that the land may become dry and firm before the heavy cattle are admitted. In the first week of eating off the grass of water-meadows, it will be proper to give the cattle a little hay in the evening, to intermix with their moist food. But the best mode of employing such grass, is to hurdle off certain pieces or spots, in the same manner as is practised for turnips. The ewes and lambs are to be removed toward the end, or at all events, on the last day, of April, by which time the land will probably be fed bare; and it should be remarked, that the closer meadows are fed, these will be more improved, and the subsequent crop of hay will be finer in quality. Immediately after the stock are cleared out, Mr. Boswell* directs a week's watering, with a careful examination of every trench and drain; taking particular care that the water only dribbles over every part of the pances as thin as possible, this being the warmest season of the year; and also to mow the long grass that obstructs the water in the trenches, which operation is best performed at this time. The weeds, leaves, &c. are to be taken out, and thrown into heaps, for carriage to the farm-yards. The first watering should not be suffered to continue longer than two or three days, before it is shifted off to another part, or meadow, which, by this time, may be fit for receiving the water; and thence to a third or fourth meadow, if the occupier possess so many. Should the season prove *wet*, the water ought not to remain so long on the ground, warmth being the greatest requisite, after the land is once wet, to assist vegetation; and in the course of five, six, or seven weeks, the meadows will be fit to mow for hay. By the time three or four parts, or meadows, have been thus regularly watered, the first will be found to have an after-math, *eddish*, or after-grass, with an astonishingly rich and beautiful verdure; and both the quantity and quality of the produce will greatly exceed what could be expected, when compared with the state of the lands before they were irrigated. This after-grass is eaten off in autumn by cattle, especially milch-kine; but

* Treatise on watering Meadows, p. 110.

sheep ought on no account to be permitted to enter water-meadows in that season, as they will infallibly be *rotted*. Although the cause of the rot is at present unknown, yet it is an indisputable fact that the autumnal feeding of sheep in water-meadows is as destructive as the vernal pasturage is beneficial to them. Hence Mr. Boswell advises, that "no sheep, except those which are just fat, must be suffered, even for an hour, in water-meadows, except in the spring of the year; and even then care must be taken that every part of the meadow be well watered." And he adds, that water-meadows, made from low, boggy, or swampy land, will infallibly rot the sheep at any other season than the spring; though a contrary effect is produced when the meadows are made from dry land.*

Having already noticed the comparative advantages resulting from the scarifying, or rolling, of grass-lands in general, we shall at present only remark, that the rolling of water-meadows during the spring is an excellent method. Mr. Boswell directs it to be done after Candlemas, when the land has been laid dry for a week; and the meadow to be rolled "lengthways of the panes," up one side of the trench and down the other. This practice also contributes greatly to the grass being mown close to the surface, an advantage of no trifling consideration; for the ant-hills, mole-hills, and other obstacles to the scythe being thus pressed close to the ground, the mowing will be fairly and clearly performed; whereas, when this circumstance is not duly regarded, the workmen will always mow over them, in order to avoid the inconvenience resulting from the edge of the scythe being taken off, and consequently the work is imperfectly executed, while much valuable seed is necessarily lost.

MOWING.

The time of cutting grass for hay ought to be regulated according to its growth and maturity for affording the best and most nourishing food; it being extremely detrimental to grass-crops to cut them too early, because the sap has not properly circulated throughout the blade; so that, when the grass is converted into hay, it shrinks, and is materially

* Boswell's Treatise, p. 112.

reduced in point of quantity. The grass, however, will receive equal injury, if it be allowed to stand till it shed its seeds; the best time, therefore, for mowing water-meadows is when the grass is in full blossom; with respect to other grass-lands, when the tops of the grass appear brown, it is an indication that it is in a proper state for cutting. Another criterion for directing the farmer's attention to this business, where grass is very thickly spread over the field, is afforded by the yellow hue which the bottom parts of the blades assume before the grass becomes in full flower; in this case, also, it will be necessary, as speedily as is practicable, to mow the grass, which will otherwise be liable to rot, or at least to acquire an unpleasant flavour, that will consequently diminish its value.

The very early or rich meadows, and highly-manured upland pastures, in the neighbourhood of large towns and cities, will be ready for mowing in June; and all meadows and pastures which may not be cut in that month, ought to be mown in July. In performing the work, the chief object is to see that the grass be cut as close to the ground as possible, and perfectly level; for grass, Mr. Young remarks, will never thrive well that is not mown quite close; and the loss in the crop of hay is very considerable, as "one inch at bottom weighs more than several at the top."—According to the present mode of mowing grass, the labourers trace two parallel lines with their feet, which they move forward alternately, after every stroke of the scythe: in lieu of this method it has been recommended, by the late eminent agriculturist, Du Hamel, to trace the mower's path in a single line only; because he ought to advance with one foot before the other in such a manner that the left foot, which is behind, should always forward the right foot. By adopting this practice, it is stated, that the labour will be performed both with greater dispatch, and also with more ease to the labourers, who will thus be secured from those sudden and painful cramps in the left side, with which they are often attacked in the common mode of cutting grass.

HAY-MAKING.

In converting grass into hay, it is of essential importance to have a proper supply of hands ready for the work. In some

districts two or three are reckoned to be sufficient to attend a mower (who, if he be an expert workman, and the soil and crop be favourable to his labour, can cut from three quarters to one acre in a day); but in the county of Middlesex the allowance is five hay-makers, of both sexes, including loaders, pitchers, stackers, &c. In that county the making of hay has been brought to a degree of perfection altogether unequalled by any other part of the kingdom; and which, after having stood the test of long practice and experience, is found to be attended with the most desirable success. Even in the most unfavourable weather, the hay made according to the Middlesex manner is superior to that made by any other method, under similar circumstances; we shall, therefore, state this practice (which is little known beyond the boundaries of that county), for the information of our readers, from Mr. Middleton's very interesting "Corrected Report of the Agriculture of Middlesex."

"*First day.*—All the grass mown *before* nine o'clock in the morning is tedded (or spread), and great care taken to shake it out of every lump, and to strew it evenly over all the ground. Soon afterwards it is turned, with the same degree of care and attention; and if, from the number of hands, they are able to turn the whole again, they do so, or at least as much of it as they can, till twelve or one o'clock, at which time they dine. The first thing to be done after dinner is to rake it into what are called *single* wind-rows;* and the last operation of this day is to put it into grass-cocks.

"*Second day.*—The business of this day commences with tedding all the grass that was mown the first day *after* nine o'clock, and all that was mown this day *before* nine o'clock. Next, the grass-cocks are to be well shaken out into staddles (or separate plats) of five or six yards diameter. If the crop should be so thin and light as to leave the spaces between these staddles rather large, such spaces must be immediately raked clean, and the rakings mixed with the other hay, in order to its all drying of a uniform colour. The next business is to turn the staddles, and after that to turn the grass that was tedded in the first part of the morning once or twice, in the

* That is, they all rake in such manner, as that each person makes a row, which rows are three or four feet apart.

manner described for the first day. This should all be done before twelve or one o'clock, so that the whole may lie to dry while the work-people are at dinner. After dinner, the first thing to be done is, to rake the staddles into *double* wind-rows;* next, to rake the grass into *single* wind-rows; then the double wind-rows are put into bastard-cocks; and lastly, the single wind-rows are put into grass-cocks. This completes the work of the second day.

"*Third day.*—The grass mown and not spread on the second day, and also that mown in the early part of this day, is first to be tedded in the morning; and then the grass-cocks are to be spread into staddles, as before, and the bastard-cocks into staddles of less extent. These lesser staddles, though last spread, are first turned, then those which were in grass-cocks; and next, the grass is turned once or twice before twelve or one o'clock, when the people go to dinner as usual. If the weather has proved sunny and fine, the hay which was last night in bastard-cocks, will this afternoon be in a proper state to be carried;† but if the weather should, on the contrary, have been cool and cloudy, no part of it probably will be fit to carry. In that case, the first thing set about, after dinner, is to rake that which was in grass-cocks last night, into double wind-rows; then the grass which was this morning spread from the swarths, into single wind-rows. After this, the hay which was last night in bastard-cocks, is made up into full-sized cocks, and care taken to rake the hay up clean, and also to put the rakings upon the top of each cock. Next, the double wind-rows are put into bastard-cocks, and the single wind-rows into grass-cocks, as on the preceding days.

"*Fourth day.*—On this day the great cocks, just mentioned, are usually carried before dinner. The other operations of the day are such, and in the same order, as before described, and are continued daily until the hay-harvest is completed.

"In the course of hay-making, the grass should, as much as possible, be protected both day and night, against rain and

* In doing which, every two persons rake the hay in opposite directions, or towards each other, and by that means form a row between them of double the size of a single wind-row. Each of these double wind-rows are about six or eight feet distant from each other.

† It seldom happens, in dry weather, but that it may be carried on the third day.

dew, by cocking. Care should also be taken to proportion the number of hay-makers to that of the mowers, so that there may not be more grass in hand, at any one time, than can be managed according to the foregoing process. This proportion is about twenty hay-makers (of which number twelve may be women) to four mowers: the latter are sometimes taken half a day to assist the former. But in hot, windy, or very drying weather, a greater proportion of hay-makers will be required than when the weather is cloudy and cool.

"It is particularly necessary to guard against spreading more hay than the number of hands can get into cock the same day, or before rain. In showery and uncertain weather, the grass may sometimes be suffered to lie three, four, or even five days in swarth. But before it has lain long enough for the under side of the swarth to become yellow, (which, if suffered to lie long, would be the case,) particular care should be taken to turn the swaths with the heads of the rakes. In this state it will cure so much in about two days as only to require being tedded a few hours, when the weather is fine, previous to its being put together and carried. In this manner hay may be made and stacked at a small expense, and of a good colour; but the tops and bottoms of the grass are insufficiently separated by it.

"There are no hay-stacks more neatly formed, nor better secured, than those of Middlesex. At every vacant time, while the stack is carrying up, the men are employed in pulling it, with their hands, into a proper shape; and, about a week after it is finished, the whole roof is properly thatched, and then secured from receiving any damage from the wind, by means of a straw rope extended along the eaves, up the ends, and near the ridge. The ends of the thatch are afterwards cut evenly below the eaves of the stack, just of sufficient length for the rain-water to drip quite clear of the hay. When the stack happens to be placed in a situation which may be suspected of being too damp in the winter, a trench of about six or eight inches deep is dug round, and nearly close to it, which serves to convey all the water from the spot, and renders it perfectly dry and secure.

"The Middlesex farmers are desirous of preserving the green colour of their hay as much as possible, though a lightish brown is of no disservice to it. Hay of a deep brown colour,

occasioned by its having heated too much in the stack, is said to weaken the horses that eat it, by promoting an excess of urine, and consequently it sells at a reduced price.*

"In the making of hay, some attention should be paid to the quality of the soil, and the kind of herbage growing on it. The hard, benty hay of a poor soil is in little or no danger of firing in the stack; and should, therefore, be put very early together, in order to promote a considerable perspiration, as the only means of imparting a flavour to such hay, which will make it agreeable to horses and lean cattle: it will be nearly unfit for every other sort of stock.

"It is the succulent herbage of rich land, or land highly manured, that is more likely to generate heat sufficient to burst into flame, as it has sometimes done: of course, the grass from such land must have more time allowed in making it into hay. This the Middlesex farmers are perfectly aware of; and, when the weather proves moderately drying, they make most excellent hay. But when very hot or scorching, they, as well as most other farmers, under similar circumstances, are sometimes mistaken. In such weather the grass becomes crisp, rustless, and handles like hay before the sap is sufficiently dissipated for it to be in a state fit to be put into large stacks. But if that be done when it is thus insufficiently made, it generally heats too much, sometimes becomes *mow-burnt*, and in some cases, though very rarely, has taken fire."

The following excellent method of making hay, particularly in *wet weather* (a most important object in our variable climate), is chiefly practised in Wensley Dale, Yorkshire, and may be beneficially adopted in the more northern parts of this island, as well as in situations similar to that of Wensley Dale; where the surrounding hills cause rain to fall much more frequently than in an open country.

The grass is cut as low as possible, and on the day following is strewed *with the hands* in such a regular and even manner,

* Observation. If you would make your hay come out of the stack of a fine colour, and the beauty of the flowers to appear, the hay you have shaken out of bastard-cocks, to prepare for carting, should be cocked in the heat, and remain till the next morning; then turn and open the cocks, for the air to take away the damp that is collected, which otherwise would heat in the stack, and of course the beauty of the colour would be done away.

that no lumps appear on the surface. In this part of the work, neither forks nor rakes are used, except where the grass is very light indeed. The next process, the day after, if the weather be fine, is, to turn it with the rake-head in a very neat and regular order: on the succeeding day, if the weather be fine, it is put into *hand or lap-cocks*; one raker goes before a cocker; each cocker takes up about 8 or 10lbs. weight of hay, shakes it up very lightly, then puts one hand a little under it, and the other on the side of it, takes it up and sets it down again gently, where it is raked clean, in a neat regular row, leaving a hole about the middle in the side of the cock, so as to admit air in case of wet weather. Cocks made in this manner, it is asserted, will repel the rain, and throw it off better than any large cocks carelessly and hastily put together with the rake or fork, and are also less liable to be disturbed by wind or tempests. This mode of hay-making is affirmed, on the test of nearly fifty years experience, to be far preferable to any other; as ricks of a circular form, with a conical head, are preferable to long ricks, being less liable to injury from the weather in this than in any other shape.*

In making hay from the grass of watered meadows, Mr. Boswell directs a *confidential* person to follow the mowers, ready to ted the grass immediately after it is cut, in which state it may remain all the first day. On the following morning, as soon as the dew is evaporated, it must be repeatedly turned, and formed into small cocks, the trenches and drains being raked clean out. The next day it is again teded and raked nearer together; the grass occupying a less space of ground in proportion as it withers: it is afterwards repeatedly turned in the course of the day, and long before night formed into *whales*, or rows, afterwards into large cocks, and the ground is again raked around them. On the succeeding day those cocks are again spread and turned: when, if they be not sufficiently dry, they are put into still larger cocks; and the following day they are opened, and the grass, after being turned, is carried to the stacks †

* In hay-making, especially in wet weather, by Mr. Milner of Scorton, near Catterick, Yorkshire, in "Communications to the Board of Agriculture," Vol. vii. Part I.

† Boswell's Treatise on Watering Meadows, p. 130.

The method recommended by Mr. Boswell corresponds, in some respects, with that proposed by Dr. Anderson. This eminent agricultural philosopher directs the grass not to be cut until it is perfectly dry; immediately after which it is to be formed into small, narrow cocks, about three feet in height, each cock being slightly thatched by drawing a little hay from the bottom of the cock, that is laid on the top, with one of the ends downwards. By this expedient the hay is stated to be effectually secured from rain and wind, except indeed a violent storm should occur immediately after forming the cocks. Provided the grass be thoroughly dry when these cocks are formed, Dr. A. asserts, they will never fit so closely as to heat; though, in the course of one or two days, they will become so firm that a hurricane only can overturn them. In these cocks, he farther directs the hay to remain for one or two weeks, till, on inspection, it is judged they will keep in pretty large *tramp-cocks*; when two men, each being provided with a pitchfork, carry the small cocks to the spot where the tramp-cocks are to be formed. The benefits resulting from this practice are stated by Dr. A. to be—1. A considerable reduction of labour; and 2. That the hay continues nearly as green as when it was first cut, and also retains its natural juice, in the greatest perfection; whereas, by tedding it, &c. as is usually done, the grass becomes bleached, its juices are exhaled, and the hay is often injured by rain. Much caution, however, must be observed, that the grass be thoroughly dry, when first formed into small cocks; as, if there be the least degree of moisture, the grass will, in a very short time, become mouldy, and clog so closely together as to be impenetrable to the air, and never become properly dry without exposure to the sun. To prevent any accident of this sort from occurring, Dr. A. recommends the mowing to begin during fine, serene, and settled weather, in the morning, and on no account to let the hay-makers touch it till the dew is evaporated. This method of making hay is but little known in England; though one instance is recorded of its successful adoption, by David Barclay, Esq. of Walthamstow, in the county of Essex, with a slight variation as to the mode of conveying the hay to the stack. This was effected by Mr. B. by fastening a cart-rope round the bottom of a large cock, which was drawn, before, by

a horse, to the stack, while a man, stationed behind, fixed a pitchfork into the cock, and thus pushed it forwards.*

A middle course has been suggested in the "*Phytologia*" of the late Dr. Darwin, between the different modes of hay-making in use in the northern and southern parts of this island. If the swath of mown grass be turned over only *once* in the day, for three or four successive days, the interior parts of it will, in a manner, be dried in the shade; and, if it were spread over the ground for a few hours in the day, he thinks the hay would become dry enough for stacking. At night, Dr. D. strenuously advises to form the grass into small cocks—particularly in damp weather—in order to secure it from being injured by the slime and excrements of the very numerous worms that rise to the surface of the ground during moist, warm nights. With this view the cocks are to be made as high in proportion to their base as possible, that a small surface may come in contact with the ground, while a broader top is exposed to the air, and consequently the exhalation of moisture from the hay is promoted, while it is at the same time secured from accidental showers.

In wet weather (no uncommon occurrence in this variable climate), Dr. Darwin is of opinion, that it is best to turn the swaths every day, or every second day, or to form it into small cocks, with the view of sheltering the whole from injury by long-continued rains, and also of preventing the parts next the ground, as well as in the middle, from fermenting. When the weather is more favourable, Dr. D. directs the hay to be made into large cocks, for the more speedy exhalation of moisture by the action of the air, while an incipient fermentation will evolve or discharge a portion of heat, and thus promote the drying of the hay by increasing the evaporation.

Various contrivances have been suggested, under the name of *hay-sledges* and *hay-sweeps*, in order to promote the getting hay together in showery or unfavourable weather. Of the former description is the sledge, employed for this purpose in Yorkshire: in loading it, the hay is previously raked into rows; the sledge is then brought to the end of one of them, and one of the horses is made to pass on each side, until a quantity proper for a load is collected together. One of them now

* *Annals of Agriculture*, Vol. xxviii.

crosses the hay-row, when the load is conveyed to the stack; after which the horses are turned round, and the sledge is drawn back to the field for another load. With this hay-sledge and two horses the hay may be loaded, and conducted to the spot where the stacks are forming, more speedily than can be effected by a cart. It is a simple and effective implement, and appears to be chiefly calculated for dry lands, the surface of which is irregular, or where the ridges are high; as Mr. Middleton's *hay-sweep* is eminently adapted for ground of a contrary description. As our limits will not permit a detail of the machinery of which this contrivance is composed, we can only state that, previously to using it, the hay is to be formed into rows; and the horses being harnessed, the drivers mount them, and drive them slowly on, so that the sweep collects the hay within it. Should the ridges be high, or the surface of the soil be irregular, it will be requisite to stick the prongs of a fork occasionally into the hay, just *before* the machine, in order that this may more effectually catch it. When the *sweep* is full, and the load is to be drawn to a distant place, the horses must be kept as closely together as possible.* In the wet summer of 1795, this contrivance was found peculiarly serviceable; and, if the drivers be steady, and the horses tractable, or accustomed to the work, *ten acres* of hay, it is said, may be effectually secured in the space of little more than *one hour*.

With regard to the *stacking*, or *housing*, of hay in barns, there is a wide difference of opinion between many eminent agriculturists. In Lancashire, and also in some of the more northern counties, *hay-barns* have been erected on pillars, and covered with slates. The floors of some of them are boarded with loosely-placed planks, perforated with holes, and lying hollow for a certain space above the ground, for the purpose of admitting a free circulation of air beneath. These buildings are cheap, useful and very convenient in bad weather; and, in those districts where large quantities of hay are made, barns are certainly preferable to stacks; for, not only is there considerably less litter and waste, but also a very material saving in straw; beside which they afford such advantages in preserving hay, as will in a short time amply repay the expense of erecting them:

* "Transactions of the Society for the Encouragement of Arts, &c." Vol. xiv. where Mr. Middleton's hay-sweep is described, and illustrated by an engraving, representing it at work.

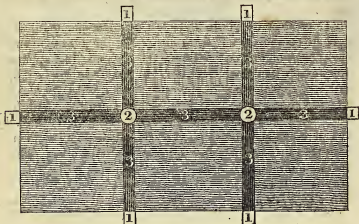
this, we trust, sufficiently appears from Mr. Middleton's statement, given in a former page, so as to render any further remarks unnecessary.

Where the practice of *stacking* hay is adopted, great caution is necessary, that the hay be not put together before it is perfectly dry; otherwise it is liable to ferment, and not unfrequently whole stacks are reduced to ashes for want of due regard to this circumstance. The shape of stacks is a matter of little moment: for farm consumption, indeed, circular stacks are preferable, particularly where straw is scarce. But the square or oblong form is preferable, where straw is no object, as they are not only more convenient in cutting out hay, to form trusses for the market, but also admit the air more fully. The size likewise depends on circumstances, and should always be adapted to the quantity of hay: the dimensions most proper for the *staddles*, or stack-bottoms, may in general be from twenty to twenty-four feet in length, by thirteen or fourteen in breadth.

In order to stack hay in the most compact manner, framed stages are commonly made use of: one of the most convenient contrivances of this description is the hay-stacking apparatus of Sir Joseph Banks, which costs about 20*l*.* It may be proper to remark, that the hay ought to be well trodden down; and that, in erecting the stack, the middle should be uniformly raised somewhat higher than the sides. Should the hay, by any unforeseen occurrence, have been damaged by sudden or successive rains, and apprehensions be entertained lest it should turn out unprofitably, Mr. Young strongly advises (and his advice is followed by the most eminent agriculturists) to salt the hay as it is stacked; strewing a peck in layers in the stack to a load of hay. It will, he observes, have a very great effect in sweetening it, however bad it may be, *even to blackness*; and experience proves, that every species of cattle will prefer inferior salted hay, which they would not otherwise have touched, to the finest hay without that addition; for the salt, by assimilating with the juices of the hay, prevents too great a degree of fermentation from taking place, and consequently prevents it from taking fire, while it imparts a superior flavour.

* This contrivance is described and illustrated by an engraving in the "Annals of Agriculture," Vol. x.

In order to prevent hay-stacks from taking fire, the following suggestion for an *improved hay-rick* was communicated to the Board of Agriculture, by A. H. Chambers, Esq. of Stratford-place, London. The idea he acknowledges to have adopted (and certainly with much ingenuity) from the distillers' patent for working during the summer, who make use of a worm through the wash, by which means they keep it at a regular temperature. The application of it only is novel, and was offered by Mr C. to the consideration of the Board, under a conviction that the present expense of hay-making would be lessened more than 20 per cent. by its adoption. The following ground plans copied from the Communications to the Board, will show the gutters and channels through which the air passes: being open, the air is constantly circulating through the centre of the rick, so that the dense air is admitted to check the fermentation, and throw off the evaporation more freely.



1. Is the opening of the trench one foot wide, and one foot deep.

2. 2. Are funnels or chimnies to be kept open while the rick is making, and until the heat has subsided, when it may be thatched.

3. 3., &c. Are channels covered with faggots.

A channel or gutter, one foot wide and one foot deep, is cut through the ground marked out for the rick, and two of these channels are cut across it, which ground is thirteen yards by nine.

Two chimnies are introduced like the common hay funnels, with this difference however, that Mr. C's chimnies go full home to the earth; "which being drawn up as the rick is forming, and the channels previously covered with faggots, except where the chimnies are placed, leave them open at all points;" so that, from whatever quarter the wind may blow, the current is uninterrupted.

The advantages stated by Mr. Chambers to result from the use of his contrivance, are various. *First*, The hay may be carried at least one day earlier, by which it is less exposed to the weather. *Secondly*, There is a saving of one day's expense in the labour. *Thirdly*, The weight of the hay is greater: for, if it be made one hour later than is absolutely necessary, it loses so much in weight by evaporation; and it is of the first importance to retain as much sap as possible in the hay, so that it be not heated to injure its colour, being more nutritious. By this means, the exhalations in the summer are not suffered to accumulate, in the same manner as in other hay-ricks, which is one cause of these taking fire. The chimnies are to be kept open until the heat has subsided, as already intimated, when they are thatched over.*

The common practice, for preventing hay-stacks from taking fire, is far less efficacious than the preceding: it consists in making holes, or forming funnels in the middle of them, in order to draw off the superabundant heat; but the advantage thus gained is counterbalanced by the increased degree of moisture attracted by the hay, which is consequently injured. Hence, necessity alone can justify their use, and, in fact, by adopting the precaution of salting the hay, the use of funnels may be altogether dispensed with. As, however, it is of some importance to ascertain the precise degree of heat in the hay-stacks, we know of no method more simple or effectual than that which was practised by the late Mr. Duckett. It consists simply in thrusting a scaffold-bolt, or other stout and long iron bolt into the hay-rick, to give an easy admission to a gun, or ram-rod, furnished at the end with a strong worm. With this he used to screw out a sample, and thereby discovered not only the heat, but also the colour of the hay; and, if the stack re-

* The utility of the contrivance above described, is not confined to hay-stacks: it is applicable with equal benefit to corn-ricks.

quired air, he perforated it in several parts in the like manner, which answered every purpose of a chimney or funnel.* Where, however, a hay-rick is discovered to be in a state of fermentation, and the convenience of a ram-rod and screw *cannot* be obtained, (an occurrence which *at present* is not likely to take place), instead of *throwing down the hay-stack*, which only accelerates the heat into a flame, from the sudden access of air, we would recommend the stack to be gradually taken down, and the exterior layers carefully detached, by which means any sudden inflammation from the current of air will be effectually prevented.

Before we dismiss this subject, we would call the attention of the industrious farmer to the minutiae of management that might otherwise possibly escape him, amid the multiplicity of his necessary engagements, viz. That he turn his store-cattle for a few days into the meadow immediately after the hay is cleared out of it, "to pick about the hedges," as the phrase is in West Devon. For the herbage, which is then succulent and edible to the store cattle, would, before the after-grass was ready to be pastured off, become unpalatable, and be altogether neglected by young cows or fatting stock, with fresh succulent herbage before them. It would, however, be evidently improper, Mr. Marshall observes, to such cattle to continue in newly-mown grounds after they have performed the principal object of attention.†

Rouen, after-math, or after-grass.—Various modes are practised, in order to make the most of the after-grass: in the vicinity of large towns, or where lambs are suckled to a great extent, it may be advantageous to take a second crop of hay, in the mowing of which greater attention is necessary than in the first instance, from the greater difficulty of cutting the grass-crops occasioned by their lightness; so that, unless in the case of very skilful mowers, the scythe is apt to rise and pass over the grass without fairly cutting it. The proper time for this purpose is, as soon as there is a sufficient length of rouen to cut, and the operation of mowing should be performed very early in the morning, before the sun can have evaporated the dew. The subsequent business varies in no respect from

* Farmer's Calendar, p. 415.

† Rural Economy of the West of England, Vol. i. p. 211.

that pursued in making the first crop of hay: less time, however, will suffice; but rouen-hay must be well made and preserved, otherwise it will become mildewed or mouldy, and be rejected by cattle. The hay from the eddish, or after-grass, of water-meadows, is very inferior to that of upland-meadows; the grass, not having had sufficient sun nor time to harden it, is soft and woolly, "and has no proof in it: cattle are fond of it," Mr. Boswell remarks, "but it will starve them." On this account, therefore, it will be advisable to turn neat cattle only into the eddish of water-meadows, as already intimated; and to remove the after-math of other grass-lands for the trying season of spring, when turnips are scarce, and the rouen will prove a most seasonable supply for ewes and lambs.

If after-grass be consumed in the general manner by feeding, shortly after the fields are cleared of hay, or in autumn, its value will be very small, rarely amounting (unless in the case of watered meadows) to more than from 7s. 6d. to 12s. or 15s. per acre, on account of the abundance of food usually prevailing at that season; but if it be kept for ewes and lambs, and other stock, in the depth of winter and the trying season of spring, when food is scarce, it becomes of the greatest value. Tolerable rouen, Mr. Young states, will carry ten ewes and their lambs an acre throughout the month of April, and will then be worth *thirty or forty shillings*; and should the season prove backward, a farmer who is provided with it would not be tempted to dispose of it for a larger sum. The young farmer, therefore, should make as large a reserve as he can possibly spare for these pressing contingencies.

Having stated in the preceding part of this work the most useful modes of consuming the after-grass, we have only to add a few hints as to the time proper for shutting it up for use during the following winter and spring. This, Mr. Young justly remarks, depends on the richness of the soils: lands of moderate fertility, which let from 12s. to 17. 5s. per acre, should be shut up immediately after they have been mown; but, in fields of greater luxuriance, that rent from 25s. to 35s. per acre, he thinks August is a better month, feeding till then quite bare; and on still richer lands, September may do. On the fine salt-marshes of Lincolnshire, indeed, there is such a spring throughout the winter, that two sheep an acre are fed without any previous exclusion. "This branch of husbandry cannot

have too much attention, for it is by far the most certain dependence a man can have for his flock, at the most pinching period of the whole year.”*

CHAP. VII.

GRASSES BEST CALCULATED FOR MEADOWS AND PASTURES.

NATURE has provided in all permanent pastures a mixture of various grasses, the produce of which differs at different seasons. When pastures are to be made artificially, such a mixture ought to be imitated; and, perhaps, pastures superior to natural ones may be made, by selecting due proportions of those species of grasses fitted for the soil, which respectively afford the greatest quantities of spring, summer, latter-math, and winter produce. Sir H. Davy, to whom we are indebted for this remark, has (in the Appendix to his “Lectures on Agricultural Chemistry,” p. 375—479,) given the results of a series of most valuable experiments made by Mr. Sinclair under the direction of his grace the Duke of Bedford, for this express purpose. Want of room compels us to refer the reader to that work: and as some observations on the same topic have already been given in our Section on the culture of grass-lands, we shall in the present Chapter invite his attention, first, to the natural grasses annually cultivated: we shall then treat of those wild or uncultivated grasses which are worthy of being cultivated; of the artificial grasses or green crops which particularly deserve attention, and lastly of the vegetables best calculated for fodder, together with the best modes of storing and preserving them.

SECTION I.

NATURAL GRASSES USUALLY CULTIVATED.

1. *Crested Dog's-tail* (*Cynosurus cristatus*). This grass will be found useful in the formation of upland pastures, as it affords a

* Farmer's Calendar, p. 451.

wholesome food for sheep : it produces a thick, short turf, and flowers about the middle of June. It abounds with seed, which may be easily procured ; but attention should be paid that the seed is *ripe*, otherwise it will fail, as was the case with eight bushels which the Rev. A. Young once ordered to be sown on eight acres, and which never came up on account of its deficiency in ripeness.* It grows naturally in dry situations, but will not thrive in very wet meadows ; and, according to Mr. Stillingfleet,† it makes a very fine turf upon dry, sandy, or chalky soils. Sheep and deer are remarkably fond of this grass.

2. *Darnel*, or *Ray-grass* (*Lolium perenne*).—This valuable grass is now well known and cultivated throughout England ; though, from its having been cultivated in improper situations, and from improper seed, a considerable prejudice has been raised against ray-grass. Sheep prefer it to any other grass, in the early stage of its growth ; but leave it for almost any other kind, after the seed approaches to perfection.‡ It is accused of running so much to seed-stalks, that, after a short time in the spring, it is refused by cattle. In a proper soil, however, this is not the case. Darnel abounds with succulent leaves, that are extremely grateful to cattle : it attains the height of two feet, and flowers toward the end of May or early in June ; and, by its early springing up, it supplies cattle with wholesome food at a time when it is very difficult to be procured. “ Clean hay, made of this grass,” says Mr. Sole,§ “ is particularly preferable for race-horses or hunters, as it does not affect their wind, nor blow them as other hay does ; and notwithstanding it runs all to bents, yet the juice is so concentrated in them as to afford greater nourishment.” He mentions an instance of a fine crop belonging to a Mr. Croom, well got in, of which his horses were so fond as to reject clean corn for it. Mr. Pacey of Northleach, Gloucestershire, has within a few years cultivated the natural sort with great success, and to such an extent as to sell a considerable quantity of the seed annually, at 10s. 6d. per bushel. It has, by competent judges, been

* “ Communications to the Board of Agriculture,” Vol. iii. p. 145.

† Stillingfleet’s Tracts, p. 390.

‡ Sir H. Davy’s Agricultural Chemistry, p. 365.

§ “ Letters and Papers of the Bath and West of England Society,” Vol. ix. p. 149.

proved to be infinitely superior to the cultivated ray-grass, and he has a sufficient demand for his whole produce.

3. *Meadow-fescue* (*Festuca pratensis*).—The meadow-fescue is an early, perennial, and very hardy grass; thriving with uncommon luxuriance in almost every soil, producing very sweet herbage, which is eaten with avidity by every sort of cattle, making excellent hay, and producing abundance of seed which may be easily gathered. According to Mr. Curtis, it bears a very great resemblance to the ray-grass, to which it is in many respects greatly superior, at least for forming or improving meadows; as it is much longer, and more productive of foliage.* It flowers about the middle of June.

4. *Meadow fox-tail* (*Alopecurus pratensis*).—This is one of the earliest grasses produced in our climate: it vegetates quickly, and with such uncommon luxuriance, that according to Mr. Curtis, it may be well cut thrice in the year. Its stalks are strong, and provided with soft, juicy leaves, of a sweetish, agreeable taste; and, when made into hay, it possesses neither the hardness of straw, nor the roughness and unpleasant taste attendant on some of the grasses. It is, therefore, justly considered as holding the first place among the good grasses, whether used in a fresh state as fodder, or made into hay. Oxen, however, relish it less than sheep and horses. The soil best suited to it is sound meadow-land, occasionally overflowed; though it will succeed on almost any soil, except the extremes of wet and dry.

The meadow fox-tail yields abundance of seed, which may, according to Mr. Martin, be easily procured; but Mr. Swayne states it to be subject to be destroyed by an insect.† Linnæus states it to be a proper grass to sow on grounds that have been drained.

5. *Smooth-stalked Poa*, or *Meadow-grass* (*Poa pratensis*).—This grass is one of the finest and most useful of any we have; it vegetates on the driest soils, and may be seen flourishing on the tops of walls. It flowers in May, and possesses the very valuable property of resisting excessive drought, having been remarked to be green in the gravelly pastures near London, when every other grass has been parched by drought. The

* Curtis on Grasses, p. 13.

† Tillet, in "Communications to the Board of Agriculture," Vol. iii. p. 428.

smooth-stalked poa yields abundance of seed, which, in a separate state, are difficult to sow, on account of their filaments causing them to adhere together. To counteract this inconvenience, Mr. Swayne recommends them to be put into newly-slaked lime, in order to separate them; and Mr. Tollet thinks, that, if they were afterwards well rubbed in a sufficient quantity of dry sand, they may then be sown with proper regularity.

Mr. Curtis says, in his valuable "*Flora Londinensis*," the smooth-stalked poa is a sweet grass, and readily eaten by cattle in general. It carries its verdure in the winter better than most others, and in the following spring throws out numerous young shoots, so as to make excellent spring food. It produces a good crop of leaves at the bottom, which make exceedingly fine hay, and is fit for cutting early in the spring.

6. *Sweet-scented Vernal*, or *Spring-grass* (*Anthoxanthum odoratum*), is one of the earliest British pasture grasses, and grows in almost every situation, though it is not equally productive: it flowers in May and June. Mr. Swayne thinks it of little consequence, as it is neither very productive to the farmer, nor relished by cattle: it is certain, that cattle will not eat it while they can get at other grasses. Other agriculturists, however, are of a different opinion; and Mr. Sole conceives, that the spring-grass would be a useful addition to meadows, if sown in the proportion of one-eighth.* This is the only odoriferous grass produced in our climate, and imparts the delicate flavour perceptible in new hay. It is less productive of seed than many of the other grasses; and Mr. Curtis states, that, in certain situations, particularly in dry seasons, its leaves are liable to become blighted, from a disease which changes their colour to an orange tinge, and which is very hurtful to this vegetable when in a state of cultivation.†

7. *Yorkshire White*, or *Meadow Soft-grass* (*Holcus lanatus*), is a perennial, flourishing well in any moist situation, and growing very generally, except on moist, barren, and dry soils: it flowers in June and July. It is chiefly calculated for sheep, and has answered uncommonly well, when closely fed. This grass is not much relished by other cattle, and is

* Sole, in "*Bath Papers*," Vol. ix.

† Curtis's "*Practical Observations on British Grasses*," p. 7.

said to be very injurious to horses, which become affected with a profuse discharge of urine and general weakness. Should any hay made from this grass be accidentally given to these animals, an immediate change of food will prevent any further ill effects. Its foliage is soft and woolly; if not disliked by cattle on that account, Mr. Curtis says, it may rank with some of the best grasses. If it were more early, it would be more valuable.

SECTION II.

WILD OR UNCULTIVATED GRASSES, WORTHY OF CULTIVATION.

1. *Sheep's Fescue* (*Festuca ovina*), is a perennial grass, growing in dry, sandy soils, and flowering in the month of June: if sown on clayey soils, it is soon overpowered by other grasses. Cattle in general will eat this sort of grass, to which sheep are extremely partial, and soon become fat from its use.

2. *Hard Fescue* (*Festuca duricuscula*), flourishes in almost every situation, wet or dry, and is in blossom in June. This grass has a peculiar claim to the attention of practical agriculturists, as it is very luxuriant, often attaining the height of three or four feet, and shoots forth very early in the spring. It affords a wholesome food, which is much relished by cattle of every sort: but Mr. Curtis has found, that, "though it thrives very much when first sown, or planted, it is apt to become thin, and almost disappears after a while." From its natural place of growth, however, he thinks it appears to be a proper grass to be mixed with those intended for sheep-pastures.

3. *Annual Poa* or *Meadow-grass* (*Poa annua*), sometimes called Suffolk-grass, grows in pastures, gravel-walks, and the borders of fields, and is in flower throughout the summer. Cattle of every description are very partial to this species of poa; and as it is found in the greatest abundance in the county of Suffolk, where some of the best salt-butter is made, it has been strongly recommended to notice by the late Mr. Stillingfleet, who conceives it to be the best for milch cows.

4. *Rough-stalked Poa*, or *Meadow-grass*, (*Poa trivialis*).—

This grass bears a great resemblance to the preceding, both in its general appearance, and especially in its time of flowering; but its qualities are widely different. While the smooth-stalked meadow-grass, Mr. Curtis remarks, is found chiefly in dry pastures, the rough-stalked poa principally occurs in moist meadows, or on the edges of wet ditches. It is eagerly eaten by sheep, oxen, and horses, and delights in moist and sheltered spots: but, though it possesses the advantageous property of being very productive, and consequently is excellently calculated either for pasturage or for hay, it is a tender grass, and liable to be injured by severe cold, or excessive drought.*

5. *Silver Hair-grass* (*Aira caryophyllea*), is common on sandy pastures, and flowers in July. Its culture is strenuously recommended by Mr. Stillingfleet, as being peculiarly well adapted for sheep-walks; as he has always observed this species to abound in those counties which are celebrated for delicious mutton.—Mr. S. applies the same remark to the heath or waved mountain Hair-grass (*Aira flexuosa*); which grows chiefly on heaths, in woods, and barren pastures. It is in flower from June to August.

6. *Creeping Bent-grass* (*Agrostis stolonifera*) affords a wholesome food to cattle, vegetating with such luxuriance as to suppress the growth of mosses and other weeds. The value of this grass has been ascertained only of late years: in Ireland it is known by the name of *Fiorin Grass*, under which appellation it was introduced to public notice in the year 1810, by the Rev. Dr. Richardson of Clonfeacle, near the Giants' Causeway. Much difference of opinion, indeed, has prevailed with respect to its real utility; but, as the design of this treatise is to diffuse practical knowledge, we shall wave all controversy, and endeavour, with the utmost brevity, to state the qualities and culture of this species of grass.

The *Creeping Bent-grass*, or *Fiorin* (as it is now generally termed), abounds in moist fields and meadows, where it puts forth a great profusion of lateral strings (*stolones*), like the strawberry, which nature designs for propagation. The root consists of numerous small fibres, not thicker than silk threads, nor more than an inch and a half in length; which do not

* Curtis on Grasses, p. 11.

penetrate deeply into the earth, and take only a slight hold of the soil. It has sometimes been confounded with the *quicken* or knot-grass, a noxious and exhausting grass of the worst quality, from the resemblance of their roots; but the difference may easily be ascertained by comparison, as the root of the fiorin is very slender and simple, while that of the quicken is long and tangled.

The qualities, which this grass is stated to possess, are as follow: 1. It grows luxuriantly in low and swampy grounds and mosses, which, but for its cultivation would be of very little or no value. 2. It grows in very great quantities; the most favourable situations, which are irrigated meadows, having been known to produce above four times the weight of any single crop which is generally raised of any other grass. 3. All horses, sheep, and cattle, are extremely fond of it, and actually prefer fiorin hay to any other hay whatever. 4. From the nature of this grass, and from the length of time which it annually vegetates, it may be used with much advantage as green food, during the greatest part of the winter. And 5. *It may be made into hay during the winter, whether the season is wet or dry.* The strings of the fiorin are said to preserve their vegetable life, for a long time after they are separated from the ground, and consequently retain their saccharine juice, thus imparting a most agreeable flavour to the hay. On this account also the hay will not rot, like common hay, when exposed to wet weather; and therefore may be cut at any period of the year, even in the midst of winter.

With respect to the mode of planting,—fiorin may be laid down in the months of September, October, and November. If the ground require draining, that operation must be previously performed, as the ground should be laid completely dry: if the soil to be laid down be a lay, it should be summer-fallowed, and all stones, roots of weeds, and other rubbish carefully gathered and removed. When the surface of the ground is well pulverized, the grass may be scattered upon it. This may be done in two ways, either by sprinkling the strings uncut, or by scattering cuttings of them upon the surface, over which cuttings whole strings are sometimes strewed. The cuttings are prepared by women, who first twist the strings into loose ropes about the thickness of the arm, which are cut by other women with a hedge-bill, upon a plank, into lengths of

about three inches and a half: it is these cuttings which are sprinkled upon the surface; but whether they, or entire strings be thus strewed, it will be necessary to lay them on the ground very thick, as otherwise there will be little or no crop obtained the first season. When this work is done, the grass should be covered with a slight top-dressing of lime and *free* or loose earth well mixed and pulverized, or with peat ashes and earth well mixed: then, if the ground be dry, it should be rolled with a wooden roller, and ought to be carefully inclosed, so as to keep out cattle and sheep. The land, laid down with fiorin the preceding year, should be weeded by hand two or three times in the following months; and if this be carefully done, there will be no occasion to weed again.*

Fiorin grass, to be in perfection, requires a moist climate or a wet soil; and possesses this very peculiar advantage, that it will grow on cold clays unfitted for other grasses. In light sands and dry situations, its produce is much inferior both in point of quality and of quantity.†

7. *Tall Oat-grass (Avena elatior)* flowers in June and July: it vegetates with uncommon luxuriance, and, though coarse, is very profitable when closely fed down; it makes tolerable hay, and produces a very plentiful after-math. In point of excellence, Mr. Curtis ranks it next to the meadow fox-tail grass (See p. 454), for which he thinks it may prove no bad substitute. Its seed may be easily procured; and, from an experiment of Mr. Swayne, it appears to have yielded a greater weight than any sort of grass.‡

8. *Yellow Oat-grass (Avena flavescens)* thrives in meadows and pastures, and on hills, in calcareous soils, where it flowers in June and July: it is a coarse grass, and though tolerably sweet, is much inferior to the meadow (poas) and fescue grasses: the late Dr. Withering has asserted, that it is not relished by cattle, though Mr. Swayne thinks it one of the

* Tracts on Fiorin-grass by the Rev. Dr. Richardson, 8vo. 1810. Farmer's Magazine, Nos. 49 and 50.

† Sir H. Davy's "Agricultural Chemistry," p. 366.

‡ Young, in "Communications to the Board of Agriculture," Vol. iii. p. 146. But according to Sir H. Davy, (Lectures p. 368), though very productive, it is disliked by cattle, especially by horses; which, he says, perfectly agrees with the small portion of nutritive matter it affords. He adds, that it seems to thrive best on a strong tenacious clay.

best grasses of this genus for the use of the farmer;* and Mr. Curtis says, it promises to make good sheep-pastures.† Sir H. Davy confirms this opinion, and says, that it nearly doubles the quantity of its produce by the application of a calcareous manure.‡

9. *Flat-stalked or creeping Poa, or Meadow-grass, (Poa compressa)*, flourishes in very dry situations, and flowers from June to August. This grass is, in Dr. Anderson's estimation, the best and most valuable of all the poas; its dark saxon-green leaves are compact and succulent, and grow so firmly together as to form a pile of the richest pasture-grass. Its flower stalks vegetate throughout the summer; and, even when decaying, the leaves retain their beautiful green colour. It produces a fine turf in parks and lawns; and imparts a delicate flavour to the flesh of sheep and deer, to which animals it is peculiarly grateful.

10. The *Meadow Cat's-tail, or Timothy-grass (Phleum pratense)*, though it delights in wet situations, seems to attain its greatest perfection in a rich deep loam: it is very productive, but coarse, and flowers late. All the agriculturists and travellers of America concur in giving this grass the highest commendations, as being the chief support of cattle wherever meadows are found. From the inquiries made by William Strickland, Esq. at the request of the Board of Agriculture, concerning this far-famed grass, it appears to be extensively cultivated on the middle and northern states of the American Union: he has frequently seen extraordinary crops of it growing as thickly as it could stand on the ground, three or four feet high, and in some instances as coarse as wheat straw. In this state it is cut before maturity; and as the hay in America is always well cured, however succulent it may be at the time of cutting, horses prefer it to every other kind of hay, and thrive better upon it. No other grasses approach it in produce; and it is stated to be particularly useful when mixed with red clover, in preventing it from falling too close to the ground.

Since his return to England, Mr. S., by cultivating it in his garden, ascertained it to be the same as the cat's-tail grass; but was doubtful whether, if it were cultivated in the field, and should grow with American luxuriance, an English sun would

* Gramina pascua. † Curtis on Grasses, p. 18. ‡ Lectures, p. 360.

be able to cure it with American perfection.* The success, however, with which it has been cultivated, prove it to be every way adapted to an English climate and soil. When used for green food, for which purpose it is particularly well calculated, it may be cut twice or three times in one season; but, when intended for hay, it ought to be cut fully a week before it flowers.† Mr. Curtis asserts it to have no excellence that we are acquainted with, which the meadow fox-tail does not possess in an equal degree.‡ The Rev. Mr. Young, however, has made several trials of keeping it closely fed by sheep, upon a moist loam, and a clay marl bottom. The success was sufficiently encouraging to evince that this plant is deserving of attention; especially as its seeds may be easily procured in any quantity from America, at the price of about one guinea per bushel; which, he observes, is enough, in conjunction with other grasses, for four or five acres of land. He observes, that four pounds (the proportion per acre fixed by Bartholomew Rocque, by whom this grass was first introduced into England), are much too little; and is of opinion, that timothy is best adapted to moist loams, especially peat.§ Whoever gives it a fair trial, will find it a most valuable acquisition.

11. *Yarrow* (*Achillea millefolium*) is one of the most common and valuable plants growing in this island; though a few years only have elapsed since its merits were announced by that excellent practical agriculturist, Dr. Anderson. It is found on moist loams, almost equally with dry, burning gravels, sands, and chalks. It possesses the singular quality of resisting drought on the most arid soils; so that if a green spot appear in a burnt-up, close-fed pasture, it may be almost certainly concluded to be covered with this plant. Five shillings per bushel are given for gathering its seed in October. Yarrow is found in the best bullock pastures, where it is highly grateful to every description of cattle, particularly to sheep, which bite it as fast as it grows; so that, on tolerably well-stocked pastures, it is rarely suffered to come into flower. It is suited to

* "Communications to the Board of Agriculture," Vol. ii, p. 162.

† Sinclair on Scottish Husbandry, Vol. ii. (Appendix) 103.

‡ On Grasses, p. 30.

§ Young, in "Communications to the Board of Agriculture," Vol. iii. p. 146.

almost every soil, flowers in June and July, and is a plant every way deserving of attention.*

12. *Rib-grass* (*Plantago lanceolata*.)—On rich sands and loams, this plant produces a considerable herbage; and, on poorer and drier soils, it is asserted to answer well for sheep, though it is inferior to some others. Mr. Marshall states, that it has stood the test for twenty years established practice in Yorkshire, and is in good estimation; though it is not well affected by horses, and is bad for hay, on account of its retaining its sap. Linnæus remarks, that it is eaten by sheep, horses, and goats, and wholly refused by cows; though the astonishing richness of the milk in the celebrated dairies of the Alps is, by the late eminent Baron Haller, attributed to the food obtained from this plant and the common lady's mantle (*Alchemilla vulgaris*, L.) Its seed is plentiful. When it grows detached from other plants, the late Dr. Withering has observed that he has never seen cattle touch it. Notwithstanding the very high recommendations which have been given to this grass, it has of late years fallen into a degree of disrepute.

13. *Cock's-foot dactylis*, or *rough Cock's-foot* (*Dactylis glomerata*.)—Various opinions, unfavourable to the culture of this grass, have been held by eminent botanists and agriculturists, as being a very coarse, common grass, unfit for meadows or pastures, and rejected by cattle of every description. It is, however, in every point of view worthy of being cultivated in a separate state, on account of its uncommon luxuriance; being refused by cattle only when growing on rank soils, or in coarse patches. Mr. Pacey, already mentioned, has not omitted to notice the valuable properties of this grass: he has sown it largely, when laying down his lands. It is permanent: his cattle are very fond of it; and never reject it but in that rank state of growth in which all other grasses seem to be disliked by them. It is a very general inhabitant of our pastures, rejecting only the extreme, not flourishing in very wet or very arid soils; it affords an abundant crop, springs early, and grows fast, makes excellent hay, and yields abundance of seed, which is not easily shaken out. It flowers in June.†

* Young, in "Communications," &c.; and Anderson's "Essays on Agriculture," Vol. ii. p. 253.

† Tollet, in "Communications to the Board of Agriculture," Vol. iii. p. 432.

14. *The Blue Dog's-tail Grass (Cynosurus cœruleus.)*—This grass, according to Mr. Curtis, is the earliest of all the British grasses, and flowers a fortnight sooner than the sweet-scented spring grass (See p. 455). It grows naturally on the tops of the highest lime and stone rocks in the northern parts of Great Britain. The blue dog's-tail is not very productive: but Mr. C. thinks it may, perhaps, answer in certain situations, especially as a grass for sheep. It endures the summer droughts remarkably well.

AQUATIC PLANTS.

1. *Flote-fescue (Festuca fluitans)*. vegetates in yet moister situations than the flote fox-tail; and may indeed be said to be amphibious, as it sometimes grows in the water, and sometimes in moist places on land. This grass flowers in June, and is a constituent part of the celebrated Orcheston meadow: horses and cows eat it with such avidity as often to endanger themselves to obtain it. It springs early, and promises to be useful for the same purposes as the flote fox-tail.* The Cheddar and Cottenham cheese, in a great measure, derive their celebrity from this grass. These remarks are in every respect applicable to

2. *The Water Hair-grass (Aira aquatica)* which is further said to contribute much to the fine flavour of Cambridge butter, and consequently deserves to be better known. It is generally found on the edges of pools and standing waters, where it flowers in June and July.

3. *Flote fox-tail (Alopecurus geniculatus)* grows in meadows on the banks of the Severn, in places so liable to inundation, that the other good grasses are expelled; and also in the moister parts of meadows, the hay of which is much esteemed for feeding cattle. It flowers in May and June, and promises to be a useful grass for newly-reclaimed morasses, or lands recovered from the sea.†

4. *Water-poa, or Reed Meadow-grass (Poa aquatica)*, "is

* Tollet, in "Communications to the Board of Agriculture," Vol. iii. p. 437.

† Ibid. p. 436.

one of the largest and most useful of British grasses, and forms a chief part of the riches of Cambridgeshire and Lincolnshire, and other countries, where draining the land by means of wind-mills has taken place. Immense tracts, that used to be overflowed and produced useful aquatics, but which still retain much moisture, are by the above process spontaneously covered with this grass, which not only affords a rich pasturage for the cattle in summer, but forms the chief part of their winter fodder.* From its strong stem and upright growth, it is calculated to remain unhurt by inundations, and is suited to those low places, which are so liable to inundation as to be unfit for the finer grasses. It has a powerful, creeping root, and will admit of frequent mowing: it flowers in July and August.† This grass is particularly abundant in the Isle of Ely, where it attains the height of six feet, though it is usually cut when about four feet high; after it is dried, it is bound up in sheaves, then formed into ricks, in which it undergoes a slight degree of fermentation, that improves it. In this state it is provincially called *white lead*, from its acquiring a white surface when dry: the inhabitants of Ely also term it *fodder*, by way of eminence, other kinds of coarse hay being denominated *storer*. It is excellent food for milch cows, but is not relished by horses.‡ By cutting it into chaff, Mr. Tollet thinks it will prove excellent winter provender.§

SECTION III.

ARTIFICIAL GRASSES, OR GREEN CROPS.

IN the course of the present work we have stated the various modes of consuming grasses to the most advantage; in the present section, therefore, it is proposed to give a concise

* Curtis's "Flora Londinensis."

† Sole, in "Letters and Papers of the Bath and West of England Society," Vol. ix. p. 152.

‡ Ibid. p. 152.

§ "Communications to the Board of Agriculture," Vol. iii. p. 437.

notice of the best artificial grasses, or vegetables cultivated and considered in that light, and which are every way worthy of attention.

CLOVERS.

There are four species of clover usually cultivated, each possessing various degrees of value, but all of which are more or less useful in feeding cattle.

1. *White or Dutch Clover* (*Trifolium repens*) is by no means a lasting plant on wet or swampy, loamy, or clayey soils; but on dry, sandy, loamy soils, it will thrive with great luxuriance, especially if it be often rolled. This sort is preferred for sheep-walks, and when closely fed down is of very great utility; it is usually sown with red clover, ray-grass, or barley, and on dry soils produces most excellent hay.

2. *Red perennial Clover*, or *Cow-grass*, (*T. medium*), better known by the name of marl-grass, continues longer in the land than the common clover, and vegetates spontaneously on marly soils; though it has been cultivated with the happiest success on sandy, loamy, and heavy clayey lands. The time for sowing it is from the middle of April till the second or third week in May. This sort, as well as the common clover, is sometimes sown with flax on very highly-cultivated soils; and, as flax is a forward plant, it may in general be removed sufficiently early to allow the clover time for growing. Red perennial clover, however, rarely succeeds when sown by itself, as it will not withstand the severity of winter without some kind of shelter. It produces abundance of seeds, which may be easily collected, and is more frequently employed for laying down land to grass.

3. *Hop-clover*, or *hop-trefoil*, or *black nonsuch*, (*T. procumbens*), grows naturally in dry meadows and pastures, and flowers in June and July. It has lately been strongly recommended to the attention of agriculturists by Mr. Amos, inventor of a new and useful drill-plough, for laying down land to grass: when mixed with the preceding species, on light soils, it affords a most excellent fodder.

4. *Common Clover* (*Trifolium pratense*) flourishes best on

firm soils, and is obtained by sowing seed, in the ratio of ten or fifteen pounds per acre, at various intervals between February and May. It is either sown in conjunction with spring corn, or (which is better on grass farms) with ray-grass; and, if it be mown when the ray-grass is coming into blossom, the lower growth will be materially increased, and a very considerable quantity of excellent grass be obtained; beside which the clover will be effectually sheltered by the rye-grass from the consequences of severe frosts. The best modes of consuming clover having been already stated, we shall only observe, for the convenience of collecting its seed, that the common clover is in flower from May to September, and that the ripeness of its seeds may be easily ascertained by the stalks and heads changing colour.

5. *Lucerne* (*Medicago sativa*) is of French growth, but was introduced into British husbandry about the middle of the seventeenth century; it flourishes most luxuriantly in deep, rich, friable loams, though it will also thrive in any good, dry soil, and in the coldest climate; but the soil must be kept as free as possible from weeds, otherwise its luxuriant growth will be greatly impeded. In order, therefore, to clean the land, Mr. Young sen. recommends two successive crops of turnips or carrots, as the most successful preparatory step; but, in case a fallow be preferred from convenience, a person ought to follow the ploughs, harrows, or extirpators, and collect all weeds for the purpose of a speedy removal. It will be necessary to give the soil three ploughings, and as many harrowings, in the second spring, before the lucerne is sown, that it may become as fine as possible; manure is not essential to its culture; but, if used at all, it should be spread with the first crop of carrots or turnips.

Lucerne may be either broad-cast or drilled, or propagated by transplanting; all of which methods have been successfully practised. The proper season is towards the middle or end of March, or not later than April; because, like the turnip, lucerne is subject to the ravages of the fly, and by early sowing it will attain a sufficient degree of growth, so as not to be affected by the devastations of the insect. If broad cast, twenty pounds of seed (which should if possible be new) will suffice for one acre; if drilled, six pounds will be enough; if the seed be de-

posited in equidistant rows of two feet. The value of lucerne crops will be greatly increased by sowing with oats, which Mr. Young prefers to any other grain, in the proportion of six pecks of the latter per acre for very rich land; of two bushels for indifferent soils; and of three bushels for poor soils. As soon as the grain is sown and harrowed, the lucerne should be sown, and a light harrow be passed over it, whether drilled or broad-cast. Where, however, lucerne is sown with the view of being transplanted, the seed should be deposited in the ground early in the spring *alone*, and be carefully hand-hoed till August, when they will be sufficiently large to be transplanted; after which they will require but little attention till the following year, excepting that it will be advisable to hoe the transplanted crops once or twice during the intervening period.

The expense of cultivating lucerne is very considerable, and should not be incurred by the young farmer without much reflection; though the great profit it affords is certainly no mean inducement to attempt its culture. The expense of drilled lucerne, Mr. Young computed (in 1796) for the first year to be as follows:

Two spring ploughings, extra	£.0	18	0
Harrowing	0	2	6
Eight pounds of seed	0	8	0
Drilling	0	2	6
Horse-hoeing in autumn	0	2	6
Hand-hoeing in ditto	0	5	0

First year . . . £.1 18 6

ANNUAL.

Rent, Tythe, and			By keeping five
Rates	£. 1	10 0	horses, from the
Four hoeings	0	10 2	beginning of May
Three hand-hoeings .	0	12 0	to the middle of
Five mowings	0	12 6	October, at 2s. 6d.
Raking together . . .	0	5 0	per horse, per
Loading and carting			week
home	0	7 6	£. 14 7 6
Manuring, to the an-			
nual amount of . . .	0	12 0	
	£. 4	9 2	
Clear profit	9	18 4	
	£. 14	7 6	£. 14 7 6

Mr. Young remarks that the expense of raking, mowing, and carting, cannot be easily calculated, unless the quantity cultivated be sufficiently large to furnish employment for a man, boy, and horse; and that, though he has estimated the cost rather high, yet it is not perhaps exaggerated, if the loss of time necessarily consequent on inadequate employ be duly considered. He would, therefore, fix the annual expense at 5*l.*, as he thinks an acre of land cannot be cultivated for less, even under the most excellent management.*

But, notwithstanding these heavy expenses, lucerne has, upon the fairest trials, been found fully adequate to them; and Mr. Young observes, that, if the value of the food be computed according the maintenance of cattle per week, *it will pay nearly cent. per cent.*

The first use of lucerne is for soiling horses, or other cattle, from three to five of which may be supported by the produce of an acre during the six summer months; the lucerne being cut twice a day, and given in a fresh state to the cattle. For fattening bullocks, also, Mr. Young thinks this plant well cal-

* "Annals of Agriculture," Vol. xxx.

culated : the experiments made with this view, indeed, are not numerous, though they evince that lucerne is, in this point of view, far superior to tares. This vegetable has also been successfully employed in soiling sheep and hogs ; and, as the latter do not feed down so closely as the former, Mr. Y. thinks they may be admitted upon lucerne plantations with safety ; and that a small field planted with it, near the farm-yard, " would be of admirable use and profit." Lucerne is also made into hay, but this management is less profitable than that of soiling cattle with it in a green state. Where, however, it is to be made into hay, it should be so cut, and the swathes so exposed as to dry quickly without shaking about more than is necessary ; as the leaves will be less liable to be separated from the stems, and the hay is consequently of more value.

6. *Saintfoin* (*Hedysarum onybrichis*) vegetates, with uncommon luxuriance, on dry, chalky soils, where it flowers in June and July. The best seed has a bright husk, the kernel being plump ; externally of a bluish or grey cast, but, when cut, internally of a fresh greenish colour.

Saintfoin requires a clean soil ; the seeds should be *fresh*, and sown towards the close of February, or early in March. The quantity varies from four to eight bushels per acre, broad-cast, according to the nature of the land ; though four bushels are, in general, fully sufficient : in the drill-culture three bushels are enough. Saintfoin, indeed, is sometimes sown with barley, as with clover, in the proportion of from one to three bushels per acre, with the addition of five pounds of *trefoil*, which last is said to check the growth of weeds till the saintfoin has taken deep root. During the first year, no cattle ought to be allowed to graze on it, as their feet will injure it ; nor should it be fed down by sheep the succeeding summer, as they are apt to bite the tops of the roots, the growth of which would be immediately checked. In the following summer, a crop of hay may be made, and the after-math fed down with cattle of any description, excepting sheep, for the reason above assigned. At the end of seven or eight years, the soil should be manured with dung ; or, if it be sandy, with marl.

In case the first season for mowing prove wet, the saintfoin ought to be left for seed ; it should, however, on no account be cut before it is in full bloom, as the quality of the hay would thus be materially injured ; but, if cut and given to cattle in a

green state, it would produce a second crop in the same year. This plant is chiefly consumed in the form of hay; but, whether thus used, or employed in soiling, it is from its great succulence equally valuable for feeding cattle, and especially horses, which are asserted to be materially strengthened by it, without the aid of oats. It ought, however, to be remarked that saintfoin, though it increases the quantity, does not, in the opinion of some farmers, improve the quality of milk in cows; while by others it is asserted, not only to make the cream richer, but also to give the butter a better colour and more delicate flavour.

Swampy soils are by no means congenial to this plant; but, as there are numerous dry, stony wastes on which it will grow, it certainly deserves to be more generally introduced into culture, especially as it will produce, on the worst lands, at least one ton of hay, together with a considerable aftermath.

7. *Bush-vetch* (*Vicia sepium*).—This vegetable grows in woods, hedges, pastures, and meadows, and flowers in May and June. It does not attain any great degree of height, seldom rising to four feet; but, as it possesses the valuable property of speedy growth after being cut, it promises to be a useful plant for pastures. It shoots earlier in the spring than any other eaten by cattle, vegetates late in autumn, and retains its verdure throughout the winter. The culture of the bush-vetch was recommended by Dr. Anderson* so long ago as in 1774, though it has not been much practised since that time, principally from the difficulty experienced in collecting the seeds; as the pods burst and scatter them about, and the seeds are frequently devoured by the larvæ of a species of *catelabus*.† From experiments that have been made in regard to the culture of the bush-vetch, it is certainly worthy of trial. A small spot of garden-ground was sown with the seeds of this plant in drills, and Dr. Withering states, that it was cut *five* times in the second year, when it produced at the rate of twenty-four tons per acre of green food, which would be nearly four tons and a half when dried. From an experiment likewise recorded by

* "Essays on Agriculture," Vol. ii.

† Withering's "Botanical Arrangement of British Plants," Vol. iii.

Mr. Swayne,* the produce of the hay, in part of a field wherein the bush-vetch naturally abounded, was twenty-four tons eleven hundred-weight and three-quarters per acre, which is upwards of one-third more than is generally yielded by lucerne.†

8. *Burnet* (*Poterium sanguisorba*).—This vegetable is chiefly used for early sheep-feeding, though it may also be cultivated with great advantage for soiling cattle. It is very hardy, being little affected by droughts in summer, or by severe frosts in the winter, and will even vegetate in that season. If it be reserved for the purpose of making hay, though its produce is in general abundant, it ought to be cut early, otherwise it will become coarse. In the culture of this plant, it is of great importance to have good seed, for which purpose a proper spot should be selected; and as the seeds shed when ripe, they ought to be cut in the morning while they are moist with the dew, and thrashed out on the same, or on the following day. Those who wish to save the seed should, according to Rocqué, who first introduced the culture of burnet, feed the grass till May, otherwise it will be too rank and lodge. Burnet flourishes best on dry soils, and may be sown in April, May, June, July, and August; for *sheep pastures* it should be broadcast, or sown with the hand; for other purposes, it may be advantageously drilled. During the first year, it will require to be kept very clear from weeds, which may be effected by harrowing; for, being a strong, tap-rooted plant, the teeth of the harrow will not injure the roots: and, in the second year, it will become sufficiently strong to choke all other grasses.

9. *Cichory* (*Cichorium intybus*), also called Common Wild Succory, is a vegetable, the value of which, for feeding cattle, has only been known within a few years. On blowing sands, or weak and poor soils, Mr. Young thinks it superior to any other plant; and he observes, that if it be sown with a portion of burnet and cock's-foot grass, it will form a layer for six or seven years, far exceeding those made with trefoil, rye-grass, and white clover. The best seed is undoubtedly that which is obtained by the farmer from the plants themselves; and, as they produce seed in great abundance, it may be easily col-

* "Letters and Papers of the Bath and West of England Society," Vol. iii.

† Ibid.

lected by hand: but the mode of sowing varies according to the intention for which it is raised. Thus, for feeding cattle, it is usually sown in conjunction with oats, or other spring corn, at the season the latter is usually deposited in the ground; but for soiling it is sown alone, from the second or third week in March till the close of summer, the earlier the better, on account of the hardy nature of this herbaceous perennial; in general, the seed is broad-cast, though Mr. Young thinks it best to be drilled alone on poor land, in rows, about nine inches, on better soil at twelve inches, asunder, after the soil has been duly pulverized; when sown, it only requires to be once lightly harrowed; but, if drilled, will be greatly improved by an occasional scarifying.*

Cichory is extremely luxuriant, far exceeding the produce of buruet, lucerne, or saintfoin, and therefore will admit of being often cut for soiling during the summer. For the first year, one or two cuttings or mowings will be sufficient; which may, in subsequent seasons, be repeated three or (Mr. Y. says) four times, beginning in April or May, and cutting every second month till October.† This plant also may be made into hay, which, though coarse, is said to afford considerable nourishment; but its chief use is for soiling cattle during the summer months; and it is likewise excellent for sheep-feeding, receiving less injury from hard stocking than many other vegetables. The culture of cichory has been carried on to a considerable extent by the late Duke of Bedford, and by Messrs. Martin, Wakefield, and A. Young, sen. of whose interesting experiments we regret that our limits will not allow a detail.‡ Its culture has, we are informed by an intelligent American agriculturist, been likewise strenuously recommended to the notice of farmers in the Western Hemisphere, though we have not yet heard with what degree of success, or to what extent it has been practised.

10. *Spurrey (Spurgula arvensis)*.—The common, or corn spurrey, is an indigenous vegetable, flourishing in corn-fields and sandy situations, where it flowers from July to September.

* Farmer's Calendar.

† "Annals of Agriculture," Vol. xx.

‡ See "Annals of Agriculture," Vols. xv. xvii. xx. xxviii. where numerous valuable accounts of the culture and applications of this plant are given.

Its culture has hitherto been but little; if at all, practised in this country; though, from the avidity with which it is eaten, it deserves to be more generally known, being peculiarly calculated to fatten sheep, as also to increase the milk of cows. Further, spurrey continues green till a late period in autumn, and often throughout the winter, on which account it has long been cultivated in Flanders; we have, therefore, been induced to recommend it to a fair trial by practical agriculturists.

11. *Tares (Vicia)*.—There are two varieties of the common tare (*V. sativa*), called the *spring* and *winter* tares; the former of which is less hardy than the latter. The spring tare is usually sown about the end of March, or early in April; and the winter tare in September (the earlier the better), in the proportion of from eight to ten pecks per acre, broad-cast: for the drill culture, half that quantity will be sufficient. Both these varieties are of very essential service in soiling cattle of every description; especially the winter tare, which comes into use just as the turnip-crops fail, and affords a succulent food to ewes and lambs. Tares are rarely made into hay, on account of the great loss they are liable to sustain from wet, as well as on account of the more than usual care requisite in making them into hay. In Gloucestershire, the winter tare is cultivated as pasturage for horses, and is eaten off so early as to admit of turnips being raised the same year. They produce abundance of seed, which the farmer will do well to collect, and keep separately, from the great resemblance which the seeds of the two varieties bear, so that they are liable to be often mixed.

There are a few other species of tare or vetch worthy of the agricultor's attention, viz.

1. The *Strangle Vetch*, or *Tare (V. lathyroides)*, which abounds in chalky and sandy soils. Its culture has lately been strenuously recommended by Mr. Amos; it affords a tender and agreeable food to sheep.

2. The *Tufted Vetch (V. cracca)* attains a considerable height, and produces abundance of leaves. This sort, which flowers in July and August, as well as the wood vetch (*V. sylvatica*, which rises from two to four feet high,) is said to restore weak or starved cattle to their strength more speedily than any other vegetable hitherto discovered.

3. The *Broad-leaved Vetchling*, or *Everlasting Tare (La-*

thyrus latifolius), has hitherto been raised in gardens, chiefly for the sake of the fine flowers. It often attains to the height of ten or twelve feet, and produces abundance of foliage. It is eaten most eagerly by cattle, and was several years since recommended to the attention of farmers by Dr. Anderson, as promising to afford a large crop of hay; though it appears hitherto to have met with little notice, in an economical point of view.

SECTION IV.

VEGETABLES BEST CALCULATED FOR FODDER.

HAVING already pointed out various economical modes of consuming roots and other crops of vegetables, by way of fodder, we now proceed, according to the intimation given in a former page, briefly to state the culture of such plants as are peculiarly calculated to supply the farmer with sufficient food for his cattle stock during the trying season of the year.

I. *Jerusalem Artichoke* (*Helianthus tuberosus*, L.) is a hardy, bulbous-rooted exotic, the culture of which, though at present little regarded, except as a culinary article, deserves to be more generally known. Its stalk often attains the height of nine feet. This plant produces no ripe seeds, but is easy to be propagated by the roots; which, when once planted, continue to vegetate in the same soil without the aid of manure, or being in any degree affected by the rigour of our winters. The roots are particularly useful for feeding *swine*, and uncommonly productive. One spirited cultivator found its produce to be about 480 Winchester bushels per acre, without manure. Another (Mr. Peters) has stated, that he obtained between seventy and eighty tons from one acre; and he is of opinion, that seven acres will produce 396 tons, which will keep 100 swine for six months, allowing each head fifty-six pounds per day, at an increase from 10s. to 15s. in value, especially if the Jerusalem artichoke be boiled in sweet hog-wash.* If these roots be given to horses, they ought to be previously cut and ground in an apple or cyder-mill: the allowance per head is

* Winter Riches, p. 48.

eight pounds, with two ounces of salt and a bite of hay, given three times in the day. As the Jerusalem artichoke will flourish on almost any soil, and its culture is by no means difficult, being the same with that of potatoes, it might be very profitably raised in many barren and unoccupied wastes: no other precaution for preserving its roots during winter is necessary, except the digging of a ditch "round the plants, to prevent the water from injuring them." For this useful fact, we are indebted to Mr. Legaux, an intelligent agriculturist of Spring-Mill, Pennsylvania, who had artichokes, raised from Dutch seed, eight and nine inches in diameter.

II. *The common white Beet* (*Beeta hortensis*, L.) though chiefly cultivated in gardens for culinary purposes, is, according to Rocque, a most excellent fodder for cows; the best way of feeding them being, to mow the plant, and to give it to them during the summer. It is raised from seed, which should be sown in the beginning of March, on an open spot of rich ground in a low situation, and may be occasionally watered. As it is of essential importance to have the soil properly cleansed, three ploughings will be necessary, after the third of which the ground should be carefully harrowed, and a rake with teeth from nine to twelve inches asunder be drawn across it, so as to mark lines; and these again must be crossed by others transversely. If the seed be fresh and sound, one will be sufficient; though, if doubts be entertained of its purity, two may be dibbled about the depth of one inch at each point where the lines meet. All weeds ought carefully to be eradicated; and, when the plants come up about a finger's length, they should be divided, and transplanted, in moist weather, to other beds. The chief obstacle to the extensive culture of this plant appears to be, the minute attention required in manuring and dressing the land, by which much labour is incurred. To obviate this, the celebrated French agriculturist, M. de Chateaufvieux, made an experiment to raise the beet according to the new husbandry: he therefore sowed it on a bed forty feet long by six feet wide; where the plants were too thick, they were thinned so as to leave a space of fourteen inches between each. On digging up the roots in October, they were all nearly five or six inches in diameter. The harvest generally begins about the end of September: the roots must be

dug up with great care, and the leaves and stalks be cut off to prevent them from growing, but so as not to injure the roots.

The *Mangel Wurzel*, or *Root of Scarcity*, (*B. altissima*, L.) is a variety of the *B. cicla*, an exotic species of beet, concerning which the highest expectations were formed in Britain some years since, respecting its usefulness as an article of fodder: though these hopes were not fully answered, it certainly will furnish an excellent article of fodder, in particular situations; especially to cows, to whose milk and cream the mangel wurzel imparts a delicate flavour: and we state with pleasure, that increasing attention is now being given to the culture of this most excellent root. On some parts of the continent, this vegetable is preferred for feeding cattle to every other root-crop, its roots and leaves not being subject to the depredations of insects; but it must be confessed, that the root of scarcity does not fatten so speedily as potatoes, turnips, or any other roots. Its abundant foliage may be given with much advantage to horses, sheep, cows, and swine; but, for the two last, the leaves should be separated from the roots, as it is asserted that cows and hogs refuse to eat them fresh from the plants. The seed of the mangel wurzel should be dibbled in the month of April or May, in the same manner as the beet, but in holes from eight to eighteen inches apart.

III. *Borecole* (a species of cabbage) is a hardy plant, which promises to be of excellent service to the grazier; as its leaves may be cut without impeding its growth, and it will, in the course of five or six weeks, produce a new crop, while the severest frosts do not affect it. Its culture corresponds with that of the cabbage which will be hereafter specified, but requires to be raised in clean and well-manured soils, and to be constantly hoed, by which means it will vegetate with uncommon luxuriance. It is particularly calculated for feeding sheep; but these animals ought not to be pastured so long upon the borecole as to injure its stalks, otherwise its future growth will be greatly checked, in consequence of its being deprived of the sprouting leaves.

IV. *Burnet*. See the preceding section, p. 471.

V. *Cabbage* (*Brassica*, L.)—Of this valuable plant there are several species cultivated in Britain; the sorts most deserving of notice are, 1. The turnip-cabbage, the seed of which

should be sown early in March, on a spot of clean land, two perches of which will supply plants enough for one acre: it is eminently calculated to resist the severity of winter frosts, and is much relished by cattle.—2. The *turnip-rooted cabbage* is a very hardy variety of the common cabbage, the seed of which is sown in June, in the same manner as the preceding species; though, if they run too much to stalk, they ought to be speedily transplanted. This sort affords an excellent fodder for oxen, cows, swine, and horses, for the feeding of which it is chiefly cultivated.—3. The *drum-headed cabbage* is also a variety of the common cabbage. Its seed is deposited in beds, either about the end of February or early in March, or sometimes in August; in which case the plants are set out in November, and transplanted in July. This kind is much relished by cows and ewes, and is said to fatten cattle six weeks sooner than any other vegetable; but only the heart should be given to cows, because the leaves (which may without injury be given to other cattle) impart an unpleasant flavour to the milk, cream, and butter of those cows which are fed with them. Should, however, any of the leaves be accidentally given to any cows, the addition of one gallon of boiling water to six times that quantity of milk, when this is exposed in the leads or other shallow vessels, will effectually remove the disagreeable taste.—4. The *green Scotch cabbage* is likewise a very hardy variety, introduced from North Britain, where it is an article of prime importance for cattle-feeding. It possesses this singular advantage, that it will grow on moor-lands; and, if it be cut a short time before the winter frosts set in, it is so well relished by cattle in general, that it is asserted, they will rarely taste any other.—5. *Rape*, or *Cole*, is also an uncommonly hardy variety, flourishing in every soil, and producing abundant crops of seed: the cakes, or refuse, of which (after expressing their oil) supply a valuable article of food for cattle. It is sown after the rate of two or three pints per acre, from the beginning of May to the end of July; but the sowing should not be deferred later, the first growth being intended for autumn feeding, and the latter for spring feed. The subsequent management of the rape being the same with that of the *turnip*, we refer the reader to that article (*infra*, No. XVI. of this section).

All the species and varieties of cabbage are subject to the depredations of numerous insects, in its early growth to the ravages of the turnip-fly, and in a more advanced state to those of the cabbage-fly (*Papilio brassica*, L.) The strewing of the soil with soot will, according to the late eminent botanist, Dr. Withering, effectually drive away the turnip-fly; as the whipping of the plants with green elder twigs, or boughs, will secure them from the attacks of the cabbage-fly. To prevent the approaches of caterpillars, it has been suggested to sow the borders of the intended cabbage plantation with hemp; and the mixing of one ounce of flour of sulphur with half a pound of cabbage seed, in a pot closely covered, will, it is said, produce similar effects. Another successful expedient for preserving young cabbages, previous to transplanting them, is to sow the seed in a box, elevated a few feet above the ground; this has been, as yet, practised only by one or two intelligent agriculturists in America. It is a question, whether it is best to transplant cabbages, or to set the seeds in the spot, and at the proper distances, where they are to grow; by the last-mentioned method, they are said to escape being stunted in their growth by transplanting: but, upon the whole, we are inclined to prefer the removal of the cabbages from the seed-beds; otherwise indeed they are liable to be too tall, and to have crooked stems. Moist weather is peculiarly favourable for this purpose; and the holes should be filled with suds (which are, in this case, better than clear water), unless the soil be naturally very moist; and Dr. Darwin has remarked that, in transplanting cabbages, it is best to *pluck* and not to *dig* them up, as by that means more of the root-fibres are torn off, and the plants become almost totally oviparous.

VI. The *Carrot* (*Daucus carota*, L.) is raised from seed, which ought to be previously well rubbed in the hands, to divest them of their beards, as they are liable to adhere together, and will come up in patches. They flourish best in light, sandy loams, which ought to be well loosened by frequent ploughing and harrowing, in order to facilitate their growth; and are best after turnips, because these roots render the soil more free from weeds than any other vegetable crop: but from a successful experiment made in the north of Scotland, there is reason to believe that they will flourish equally

well in *peaty soils*.* When broad-cast, they will require to be thinned out to the distance of half a foot asunder, and should also be hoed, in order to give every possible facility to their growth; after they have been thus hoed, a harrow is sometimes passed over them with the same view, and without any injury to one plant, perhaps, in fifty. After harrowing, however, it will be advisable to go among them, and uncover such of the roots as may be buried under heaps of mould. For cattle of every description, carrots supply an excellent and nourishing food; and, as far as respects the amount of their produce, and their freedom from the ravages of vermin, they are greatly superior to turnips; but, as they will not withstand the winter like cabbages, if left in the ground, the following mode of preserving them has been suggested, and successfully practised, by some agriculturists. Soon after Michaelmas, during dry weather, let the roots be dug up, and piled upon an earthen bank, raised about six inches above the level of the soil, and adapted to the quantity of carrots intended to be stored. On this is then to be spread a thin layer of dry straw, and on this the carrots are to be placed, two or three deep, with successive intervening strata of straw; the tops being turned outwards, and their ends folding one over another, while the smaller roots are *topt* and thrown in the centre. The stacking may be continued to the height of about four feet, when the whole is covered with an additional quantity of straw, and thatched with sedge. Another line is then commenced in the same manner, leaving room for one to pass between; and the interval is next filled up with dry straw, and the outsides defended with bundles of straw staked down, or fastened with hurdles. Thus arranged, carrots will be effectually secured from frost, and afford a regular supply of wholesome fodder at a time when almost every other vegetable is destroyed.†

* Sir John Sinclair on Scottish Husbandry, Vol. i. p. 308. Another important discovery has recently been made in Scotland respecting the culture of carrots, viz. that by raising alternate rows of carrots and onions, the former are protected from the depredations of insects, to which the smell of onions is probably offensive. This practice may easily be carried into effect where carrots are cultivated in gardens, if not to carrots cultivated in fields. Ibid. p. 308.

† "Annals of Agriculture," Vol. xi. See also an interesting paper on the cultivation of carrots, in "Communications to the Board of Agriculture," Vol. vii. Part i.

VII. *Parsnips* (*Pastinaca sativa*, L.), though refused by cattle in a wild state, afford, when cultivated, an article of food; which, from recent trials, appears to be superior to almost any other root for fattening oxen, and especially swine, as well as for improving the quality of milk. The seed should be sown either in autumn, immediately after it is ripe, or in February or March, otherwise the growth of the plants will be impeded by weeds. If broad-cast, parsnips require to be thinned to the distance of ten or twelve inches apart; if dibbled, the seed should be deposited in rows eighteen inches asunder, and ten inches distant one from another in those rows. They should be horse-hoed twice, and, after the second hoeing, be earthed up, though not so as to bury the leaves. The parsnip flourishes best in rich, deep loams, though it will do well on sandy soils. In the isle of Jersey, where the parsnip-husbandry is perhaps most successfully prosecuted, these roots and beans are generally sown together after barley. The following is the system usually pursued:—

The soil is either dug with a spade after a skimming plough, or stirred with two ploughs of different shapes following each other, as the soil for this purpose must be stirred from the bottom. In Jersey, a plough is made for this sole purpose, which will go to a depth of fifteen inches. This operation is performed in January or February: the ground thus tilled is then coarsely harrowed, and beans are dibbled by women in rows five feet asunder; after which, the parsnip seed is sown broad-cast, and the whole finely harrowed. In May, the ground is carefully weeded both by hand and with a small weeding-fork; and the hand-hoe, to thin the crop like turnips, has been used with advantage. In the beginning of September, the beans are pulled from the parsnips; and, towards the close of the same month, these are begun to be taken up, but are only removed as they are wanted for the cattle, until the ground requires to be cleared for sowing wheat, which is generally by the middle of December. The unconsumed part is then brought dry under sheds, and will keep good without any care till the end of March: but if they are to be kept longer, they are stacked in double rows, one over another, with their heads outwards, with alternate layers of earth. This method is always adopted for such roots as are intended for seed, and for culinary purposes: they are not injured by frost, and

possess the very valuable property of vegetating after they have been frozen.

Parsnips are given in a raw state, with great advantage, to hogs and horned cattle; but they render horses languid, and it is said are apt to injure their sight. Cows fed upon them during the winter months, are stated to produce a greater quantity of milk and butter, and of better flavour, than when fed upon potatoes. The leaves, however, must not be used, as they impart a very disagreeable taste. Parsnips are considered to be dangerous food for sows before they farrow, but hogs may be fattened with them in about six weeks; and they are sometimes given to sheep for the same purpose. It is a general opinion in Jersey, that all cattle may be made fit for slaughter in less time, and with half the time that would be required with potatoes; and the butchers give more for them in proportion to their weight, as they always contain a greater quantity of tallow.*

VIII. *Buck-wheat* (*Polygonum fagopyrum*, L.) vegetates with great luxuriance in dry, loose, and sandy soils, that are open to the effects of the sun; though the variety known by the name of Siberian buck-wheat, which is much heavier and more palatable in the grain, will thrive in the poorest soil, and is not at all affected by cold. The best, and indeed the proper season for sowing it is towards the end of May, or the commencement of June; and, in the course of a week, it generally appears above the ground: the quantity is from one to three bushels per acre. Buck-wheat requires little or no manure; on the contrary, when ploughed down in a green state, it greatly ameliorates the soil, and, if suffered to attain to maturity, affords an excellent food, either for soiling or for winter store. Given to horses employed in slow draught, in conjunction with bran or chaff, whether the seeds be in a whole state or bruised in a mill, it will put them into fine condition; in a recent or green state, it greatly increases the quantity of milk. The seeds of the buck-wheat are excellent for fattening poultry and swine; but the last-mentioned animals should, if possible, be kept from eating the whole vegetable, as it is asserted, not only to intoxicate them, but also to cover them with scabby eruptions.

* M. Le Hardy, on the Culture of Parsnips, in the Agricultural Magazine, No. 33.

IX. *Furze* (*Ulex Europæus*, L.) though by many regarded as a noxious weed, may be advantageously cultivated in light, sandy soils, by sowing its seed in February, March, or April, or at all events early in May, in the proportion of six pounds per acre. In the month of October, or perhaps a little earlier in the following year it may be mown, when it will continue till Christmas, and be fit for use till March. Furze requires to be bruised in a mill before it can be eaten by cattle, but it is very invigorating; and if given to horses, after being recently bruised, they will, it is said, prefer this shrub to hay, or even to corn. It will continue growing for several years, producing from ten to fifteen tons per acre, which are in some districts considered as equal to the same quantity of hay; and therefore it is regularly stacked for winter use.

In addition to furze, it is probable that horse-chesnuts would form a valuable (though hitherto neglected) article of food for horses. In Turkey, the practice is to grind the nuts, and mix them with other food, which is given particularly to such horses as are troubled with coughs. If the horse-chesnuts be previously boiled a little, in order to remove their bitterness, and afterwards be bruised and mixed with a little barley-meal, they may be advantageously employed in the rearing and fattening of poultry.

X. *Rye* (*Secale cereale*, L.)—Of the common rye there are two hardy varieties, spring or white rye, and winter or black rye, the former of which may be sown from February to March, and the latter from the middle of September to the close of October. The quantity of seed per acre is from two bushels to two bushels and half, Winchester measure, on poor, sandy, or dry lime-stone soils. On farms where wheat forms part of the rotation of crops, both the spring and winter rye are advantageously sown, in the proportion of one peck of rye to one bushel of wheat. Rye may likewise be harrowed in with a thin crop of turnips, and both be fed off with sheep. Either for pasturing or for soiling, rye supplies an excellent article of food to sheep as well as to horses and cows; the former may be fed off with it in the spring, the latter somewhat later. It is not, however, cultivated to any considerable extent, from its being liable to the depredations of an insect, that causes it to become horned or spurred; in which state it is very pernicious to cattle.

XI. *Oats* (*Avena sativa*, L.)—There are several varieties of the common oat, all of which are eminently calculated for cold, poor, and dry soils, as well as marshy ground, or land newly broken up.—1. The red or brown oat ripens early, and does not shed its seed: it is very useful for feeding cattle, as its variety, the Peebles oat, which will stand on any exposed or mountainous districts, without being injured by the severity of the weather. 2. The white oat also attains early to maturity; though its variety, the Angus oat, is less forward in ripening, it requires a drier soil than either of the preceding articles. Or, 3. The black oat, which is a long, heavy, and hardy sort, particularly good for horses, and which is chiefly cultivated in North Britain.—All these varieties are raised from seed, the proper season for sowing which is from the middle of February to the commencement of June; the quantity per acre, if sown alone and broad-cast, being from three to six bushels, to which are sometimes added one bushel of darnel or rye-grass, and twelve pounds of clover. The seed is then harrowed in, and requires but little subsequent management. Oats may likewise be advantageously drilled, though this practice, as far as respects them, has not hitherto been carried on to any great extent. Beside the indigenous varieties already noticed, there are a few foreign species worthy of notice, and which will withstand the severity of a variable climate, viz.—1. The Poland oat, together with its variety, *Church's oat*, first raised in Scotland, require a very rich soil; both ripen early, and easily part with their grain when ripe: the quantity sown is seven or eight bushels per acre, in March or April.—2. The Friesland oat, to which the same remarks apply: the quantity per acre is about six bushels. These two species are raised chiefly for feeding horses.—3. *Skegs* (*Avena stipiformis*, L.) will vegetate luxuriantly on the poorest soils. This species is said to be a very wholesome food for, and is much relished by horses, cows, and ewes before they rear their lambs; especially when given with the straw, either in a whole or in a chopped or bruised state. Oats are liable to the *smut*, a disease common to most kinds of grain, and which is believed to originate from the depredations of an insect. The most likely preventive is, to wash the seed gradually and repeatedly in a sieve, in running water, till all the light grains are separated; or, it may be advantageously steeped in diluted vitriolic acid, in the proportion of one gallon

of the acid to about thirty gallons of water. They are likewise subject to the depredations of a grub, which begins its ravages early, and continues till May or June, when it is transformed into a chrysalis, and at which time only it is vulnerable. At this season the refreshing vernal showers destroy immense numbers; in fact, all but such as may have taken shelter in the coarse and luxuriant weeds usually found in ditches and on banks, or in soft and dry mole-hills, whence the eggs of the vermin are conveyed by the air or wind into the field. The only probable preventive is to remove all such rubbish from the vicinity of the oat-field; and consequently, the insects being deprived of their shelter will be exterminated by the winter rains.

XII. *Peas (Pisum sativum, L.)*—There are many varieties of peas cultivated, which it is not necessary here to specify; as the principal sorts for field-culture may be reduced to two, the *white* and *grey*. The proper season for sowing the white pea is from the end of February to the first or second week in March, in a light soil, with about two bushels and a half of seed for the large sort; the grey pea, from the end of January to nearly the middle of March, on a strong soil, with about three bushels of seed per acre. The drill-husbandry is most easy and certain; and the seed should be put in double rows, about fifteen inches asunder, with an interval of about thirty inches distance between the double rows. The wide intervals should be cultivated with a small plough, or cultivator, the narrow ones with a hand-hoe; and when the plants are advanced, and before they fall down (for peas, being weak, climbing plants, are liable to fall on the ground according to the common broad-cast husbandry), by earthing up the rows a little, they will lean towards each other, unite and form one row, and thus be supported, so as to blow and form their pods without falling on the ground. The distances here specified are calculated for the earlier and smaller sorts of peas; the larger kinds will require more room between the double rows, and, if the farmer should not be provided with a drill-plough, he may sow his peas thinly by hand into every second furrow after the plough. It should be observed, that one-third less of the quantity of seed above stated will suffice for the drill-culture; but, as peas are liable to be worm-eaten, especial care should be taken to sow only good, sound seed, otherwise the crops will of necessity be scanty and indifferent in quality. This kind of pulse may be sown after

turnips or clover, upon one ploughing; but are best after a winter fallow, and the land in good tilth. When peas are cut, they should be laid in small heaps, and be frequently turned with a fork, being very apt to receive injury, and sprout by lying on the ground, without being often turned; and great care is necessary in turning them, to prevent the pods from shedding.

Peas are chiefly used in fattening swine; and, when bruised and given to cows, in conjunction with other succulent meal, they are said to give a flush of milk. Their haulm, if carefully sown in a favourable season, affords a wholesome fodder to neat cattle.

XIII. *Beans.* The sort of beans usually cultivated for feeding cattle is the horse-bean (*Vicia faba equina*, L.), of which there are several varieties; the large ticks or *negro* beans, the small ticks, and the common sort. They will all grow under the same system of culture, only requiring more or less room according to their size. Beans are more hardy than peas, and also a more certain crop; but they require much nourishment, and the soil ought to be well manured for them. They may be cultivated in the same manner as peas, and likewise on three-foot ridges, and thus they are easily kept perfectly clean with the horse-hoe and hand-weeding; hoeing the ridges alternately. This is a much better and cheaper way of cultivating beans than the common way, upon the level ground. The quantity of seed necessary is about a bushel and a half of common beans upon an acre, which should be drilled about four inches deep, the latter end of January, and thinned to about three inches distance in the rows, leaving the most promising plants. They should be frequently horse-hoed, and near to the plants; and the slips of earth left next the rows by the hoe-plough should be hand-hoed, and the rows hand-weeded. Thus great crops may be obtained from the common sort, and the land brought in fine order. There is a further advantage in this way; that less manure is necessary to a crop of beans thus cultivated, than if planted upon the level and hand-hoed. The sun and air is likewise more freely admitted among them; and, as they do not grow so tall as when close planted, they blossom and produce pods almost down to the ground; whereas the tall, close beans produce them only near the tops of the stalks.

The close-planted are also infested with the dolphin-fly, but not those which are drilled on ridges.

XIV. *Lentils* (*Ervum lens*, L.) may be sown in the quantity of one and a half or two bushels broad-cast; or they may be drilled in rows eighteen inches asunder, for the convenience of cleaning the intervals with the Dutch hoe. Sometimes the lentil is put in the ground with the proportion of two bushels of oats, or one bushel of barley: but whether thus cultivated, or grown alone, they ought to be cut while in full sap; because, when well dried and preserved, they afford a wholesome fodder to cattle, especially to cows; the quality and quantity of whose milk they materially increase; and also to swine, which will very speedily fatten on them.

XV. *Of Potatoes* (*Solanum tuberosum*, L.) there are several varieties cultivated for culinary purposes only, while others are raised solely for the purpose of feeding cattle-stock during the winter, for which purpose these roots are admirably calculated when properly sliced and steamed; of this last description are the Surinam or hog-potato, the Howard or clustered potato, the ox-noble, red, and Irish purple potatoes. All these sorts flourish with great luxuriance in light, loamy, sandy soils; though they will grow in any tolerable land. The ground ought to be previously ploughed twice or thrice, and just before the last ploughing, a good quantity of rotten dung* should be spread, and ploughed down early in March, if the weather be open; but if it be frosty, that business should be deferred till the end of March, or the beginning of April. After the last ploughing, the ground should be levelled, and furrows be made about three feet asunder, and seven or eight inches deep. In the centre of these furrows are to be set the entire roots, eyes, slips, or rinds (for all these have been successfully planted, and have produced excellent crops), which should be covered with earth; and, a little before the young plants appear, it will be advisable to pass a light harrow over the whole, to eradicate all weeds, and remove every hindrance to their growth. As the potatoes increase, they

* From 15 to 20 cart-loads per acre are, in general, sufficient; too much dung prevents potatoes from becoming mealy, and they are in consequence liable to become waxy and watery.

should be earthed up twice, which operation will greatly promote their growth.

Potatoes are subject to various injuries from insects, as well as to various diseases, of which none is more fatal than the *curl*, so called from its causing the leaves of the plants to curl, though agriculturists are by no means agreed as to the cause of it. And, as it would lead us into a wider discussion than our limits will admit, we shall only state, that the steeping of the sets for two hours in a strong brine, made of Whitsters' ashes, is believed to be a preventive; so likewise is the raising of potatoes from new seed, changing the seed, or renewing the same sorts again from the same seed. The proper time for digging up potatoes is in autumn, when their stems and foliage are beginning to decay; this operation should be done in dry weather, after which the roots may be piled up in dry spots, in heaps resembling the roof of a barn, and thatched with straw, slightly covering them with mould, which is beaten down with a spade. Holes are sometimes made in the sides and on the top, to afford a passage for the air arising from the natural warmth of the potatoes, which may be filled up as soon as the evaporation of steam ceases, in order to prevent them from being injured by frost or rain.

Beside their utility, when steamed, for feeding and fattening cattle in general, potatoes are particularly serviceable in fattening swine, though a little variation will be necessary in preparing the roots, where the animals are intended for bacon or hams; in which case equal parts of ground peas and boiled potatoes must be gradually mixed together; and it has been asserted, that *eight* bushels of the mixture will be sufficient to fatten an animal weighing *twelve* stone.

XVI. *Turnip*. The varieties of this root, most commonly cultivated for feeding cattle, are, 1. The *Norfolk*, or oval, common white stock; and, 2. The *Ruta бага*, or Swedish turnip, which is a very hardy, succulent vegetable, much relished by cattle, and is in no respects injured by the severest winters. These roots will be reared to most advantage on light soils, consisting of loam and sand mixed together: the seed is sometimes broad-cast; but repeated experiments have shown that it is far better to drill the seed, in which case one pound will be sufficient, whereas the broad-cast method will require three pounds. The soil ought previously to be rendered as fine as

possible; and if soot be applied by way of manure, it will, it is affirmed, effectually prevent the ravages of the *fly*. The time of sowing depends on the season of feeding cattle off with turnips: thus, for winter consumption (i. e. from December to February) the seed should be sown from the middle of May to the close of June; for spring feed (i. e. from February till May) the end of July or beginning of August will be sufficiently early. But the seed ought to be changed every year, or every second year at the farthest, as the turnips will otherwise degenerate; and it should be deposited at the depth of two and a half or three inches, in order that it may have the greater moisture, and in consequence vegetate so rapidly as to be speedily out of the reach of the *fly*.*

When turnips have five leaves, it will be proper to hoe them, (in which operation the turnip-hoe, described in p. 265, may be effectively employed,) and afterwards to thin them out to the distance of six inches asunder, which operation should be repeated in the course of three or four weeks, or even earlier, if the weather be wet, and the turnips be then thinned to the distance of fourteen inches apart. The success of their growth also depends greatly on the removal of all weeds, for which purpose a horse-hoe will be found very useful: sometimes, however, it happens that, notwithstanding every attention that may be bestowed on the culture of turnips, several spots will remain barren and unproductive. To remedy these inconveniences, the implement represented in the annexed figure was invented a few years since, by Mr. Cubitt Gray, an intelligent Norfolk farmer. The method of using his transplanter is as follows: the handle A is to be held with the left hand, and the short handle B drawn up with the right. The implement is then to be put over the root intended to be transplanted, and forced into the ground with the foot; then after twisting it round, it should



* See figures and descriptions of two excellent turnip-drills, p. 251—256 *supra*.

be carefully drawn up, so that the soil may adhere to the root. In the mean time an attendant, likewise furnished with a transplanter, should make a hole for receiving the turnip, which is to be conveyed thither in the first transplanter; and, the right hand being kept steady while the left is gradually raised, the root will be left in the hole undisturbed.*

Having, in the former part of this work (pp. 142—146), detailed various modes of consuming turnips in feeding cattle-stock, we shall conclude this outline of their culture with a brief notice concerning the depredations of insects, and diseases to which they are peculiarly liable.

1. The *anbury* is a large excrescence, which forms itself below the apple. It grows to the size of both hands; and, as soon as the hard weather sets in, it attains to maturity, becomes putrid, and emits an offensive odour. The cause of this disease is not known: some Norfolk farmers, indeed, attribute it to the too frequent culture of turnips on the same land; but this idea is positively denied by Mr. Marshall, who inquires whether it is not caused by the devastations of a grub, that, wounding the vessels of the tap-root, diverts the course of the sap, which, instead of forming the apple, forms this excrescence. Should this conjecture prove correct, the depredations of the worm may probably be prevented by putting soap-boilers' ashes, by way of manure, a short time before the seed is drilled.

2. The *black canker* is a species of caterpillar, thus denominated by Norfolk husbandmen, which commits very great devastations among turnips, when the plants are in the state of growth termed *rough leaf*, that is, have formed considerable tops. The best method of destroying these insects is, to turn the flock of ducks into the field infested with them. This expedient was successfully adopted in 1784, by Mr. Coke, of Holkham, who purchased 400 ducks, and turned them on thirty-three acres of turnips, which they effectually cleared of the canker-caterpillar in the course of five days. There is no doubt but that on a small farm, a less number might be advantageously kept for this purpose. As a preventive, indeed, we know of no certain expedient, unless perhaps the sowing of turnip-seed on land so highly manured as to advance the growth of turnips quickly into the state of rough leaf long before the insect makes its appearance.

* Bath Papers, Vol. iv.

3. The *fly* or *black fly*, (*Crysmela oleracea*, vel *nemorum*, L.) ravages chiefly the tender seed-leaves of young turnips, and, if not timely prevented, will completely destroy them. The sowing of turnip-seed between beans has been suggested as a preventive; as also has the addition of one-fifth part of radish-seed, rolled into the ground. Radish-seed, however, is not in all cases a preventive, though we understand a Norfolk cultivator, some time since, received a handsome sum for divulging this remedy; for we have been informed, that Mr. Dunning, of Blackwater, Hants (deceased), late an eminent coach-master on the western road, and also an intelligent cultivator, tried the experiment of radish-seed on seven acres of turnips, which were almost totally destroyed by the fly; while a contiguous field, which he had sown with turnip-seed and sulphur, escaped altogether unhurt. The proportion of flour of sulphur we would recommend, from experience of its good effects, is three ounces to one pound of seed, to be added in the following manner; put the seed and one ounce of sulphur into a glazed earthen vessel, and cover it closely down for twenty-four hours; at the end of that time, stir the mixture, and add a second ounce, covering it as before; and at the end of forty-eight hours mix the third ounce, carefully stirring the whole, that the seed may be properly impregnated with the sulphur. It is then to be sown in the usual manner, and will effectually keep off the vermin till the third or fourth seed-leaf is formed, which will acquire a bitter taste, and thus be secured from the ravages of the insect. Another efficacious remedy, which was adopted by the late Lord Orford, is the steeping of the seed in train-oil the night before it is sown;* but, in this case, the seed should be drained from the oily fluid, and mixed with finely-sifted sand or mould. By this treatment the roots will not acquire any ill flavour; and seven gallons of oil will, it is said, be enough to steep seed for sowing 200 acres. It is probable that this steep may prevent the attacks of the black canker caterpillar. Quick-lime, finely powdered, and dusted over the seminal leaves of the turnips, as soon as the fly begins to threaten them, has been found a never-failing preventive of the depredations of these voracious insects,† even where soot

* "Annals of Agriculture," Vol. xiv.

† Gorrie, in "Transactions of the Caledonian Horticultural Society."

manure has failed. Sir H. Davy thinks that the mixture of soot and quick-lime, and urine and quick-lime, will probably be more efficacious: the volatile alkali, given off by these mixtures is offensive to insects; and they afford nourishment to the plant.*

4. *Slugs* are likewise great depredators on turnips; for extirpating which, some have recommended the rolling of the ground during the night, while these vermin are abroad; as also the strewing of the lime in the evening, or very early in the morning, at the rate of fifteen bushels per acre. Geese and ducks may, as in the case of the canker (p. 489). be advantageously turned into turnip-fields; but the most expeditious means of destroying these vermin is the sprinkling of tar-water, by means of a watering-pot or other contrivance, on the land, before as well as after sowing, which will prevent their depredations; and which, if poured on them, will occasion instantaneous death. Captain Shank† directs the tar-water to be made by pouring a sufficient quantity of tar into a barrel, and to fill it up with water, which, after standing two or three days, will become powerfully impregnated with the tar.

As turnips are of such importance to the farmer, grazier, and breeder, the most effectual mode of preserving them becomes an object of considerable moment; we shall, therefore, conclude this notice of their culture with a concise statement of the best means of keeping these roots. In the county of Norfolk, Mr. Marshall has recorded an instance of successful industry, in the preservation of turnips. A farmer having a close of turnips, which he could not consume fast enough to be sown with wheat, cut off the tops with a spade, gave them to his cows, and carted the roots into an adjoining new-made ditch,

* Davy's Lectures on Agricultural Chemistry, p. 320. Sir H. D. records a successful experiment of Mr. Knight's, with a composition, consisting of three parts of soot with one part of lime slacked with urine: it was put into a small barrel with gimlet holes round it to permit a certain quantity, about four bushels per acre, to pass out, and to fall into the drills with the turnip seeds. Whether it was by affording highly stimulating food to the plant, or giving some flavour which the flies did not like, Mr. Knight cannot state: but in the year 1811, the adjoining rows were eaten away, and those to which the composition was applied, as above described, were scarcely at all touched.

† Shank in "Bath Papers," Vol. viii.

backing the cart, and shooting them in; he then covered them with a little straw, and over this with bramble *kids*, or faggots, to keep the stock from them. Here the turnips continued till they were wanted in a frost; the cart was then backed to the ditch, and the turnips loaded with a fork. The roots in general came out as sound as they went in, and were eaten by his cattle as well as, or better than fresh-drawn turnips. Had the tops been deposited with the roots, they would, Mr. M. observes, have produced a fermentation, and spoiled the whole deposit.* It is not improbable but that this practice may be extended to the preservation of turnips in the spring; but this management, it should be remarked, is only capable of being adopted in dry, porous, or sandy soils; in which, as suggested by an able agriculturist, pits or beds may be dug, about two feet in depth, and of a considerable breadth, in turnip-grounds, wherein five or six layers of turnips may be put, with a little fresh earth between each of them, the tops being covered with straw.† Further: turnips may be drawn, topped, and carted into a spot contiguous to the home-stead, where they may be stacked, without any loss of labour, by reason of the ready supply they would afford for shed or straw-yard bullocks.‡ Lastly, after drawing turnips in February, and cutting off their tops and tap-roots, (which may be advantageously given to sheep), they may, if the weather be dry and open, continue on the soil for a few days; then let a layer of straw be spread on the ground, and on this be placed a bed of turnips, about two feet in thickness. These alternate strata may be carried up gradually to a point, the edges of the straw being carried up gradually to a point, to prevent the roots from rolling out. Next, let the whole be thatched with straw, one load of which will be sufficient for forty tons of roots; and these will be effectually preserved for many months uninjured by frost or snow.

The following method has likewise been very successfully employed by Mr. T. C. Munnings, whose valuable turnip-drill we have already noticed. Having observed, that the drill-system alone could facilitate the protection of the turnips while on the land where they were grown, Mr. M. states that, in

* Marshall's "Rural Economy of Norfolk," Vol. ii. p. 109.

† Kent's "Hints to Gentlemen of Landed Property," p. 121.

‡ "Marshall's Norfolk," Vol. ii. p. 110.

1800, he at length effected this desirable object, by removing the *alternate rows for autumnal consumption*; thus leaving rows about one yard asunder, and then with a one-horse plough moulding up the same. His land thus assumed the appearance of what is called *two-furrow work*, or perhaps, more properly, *tops and balks*, each top embracing and defending a row of turnips, and the balks being in the lines from whence the turnips were removed: the whole were most completely moulded up, and seemed to bid defiance to a winter's severity.*

So completely has this plan answered, that Mr. Munnings affirms, that, if any individual will contrive to mould up his turnips in the autumnal month, before the severe frosts set in, such turnips will be so much better than those which have received *no* artificial protection, as will abundantly compensate the extra care or labour thereby occasioned.

The following is the method Mr. Munnings most decidedly approves, to which he proposes in future to adhere, and which he recommends to general notice—"Suppose the following eight lines, No. 1, 2, 3, &c. to represent my rows of turnips on a ridge—*eight* being the most convenient number of rows for the easy execution of the work.

1
2
3
4
5
6
7
8

"Conceive half of these lines to be upon one ridge, and half upon another; in that case there will be a furrow between 4 and 5—this furrow is to be opened with a double-breasted plough, which will raise mould for the protection of what I will call the insides of those two rows, 4 and 5; the rows 1, 2, 3,

* For this interesting fact, as well as the following statement, we are indebted to Mr. Munnings's interesting "*Account of some Experiments for drilling and protecting Turnips,*" &c. 8vo.

are then to be pulled and put into the open furrow (between 4 and 5), with their tops inclining towards 4. In the same manner the rows 6, 7, 8, are to be pulled, and put into the same furrow, with their tops inclining towards 5. Two or three furrows are then ploughed with a one-horse plough to the outsides of 4 and 5, and some mould from the third furrow so ploughed, shovelled unto the top of the collected rows, (of this shovelling I think, from what I had done, that a good labourer will finish two acres in three days), and with the one-horse plough, the ploughing may then be finished, so as to give the land a complete earth.

“By this plan the whole of eight rows are collected into a small space; and if the frost be very severe, and other turnips (unprotected, or protected but in single rows) be difficult of access, the land being kept open by the tops of four rows united in the lines 4 and 5, may most easily be removed from the top of them, and the whole body of the turnips so collected will be found unfrozen. From turnips thus defended, I sent specimens of unfrozen roots and very lively tops to many gentlemen and farmers during the most severe days of the frosts of the winter just past, at a time when other turnips, not protected, were as hard as stones. I sent specimens to many market-rooms of farmers, to show, from time to time, the validity of my plan. And from beds of turnips thus defended, I have no hesitation in saying, that one man may, with ease, feed more stock with sound, uninjured food, than five men possibly can from any crop of broad-cast unprotected turnips.”

CHAP. VIII.

OF THE ECONOMY AND MANAGEMENT OF
THE DAIRY.

SECTION I.

SITUATION AND BUILDINGS PROPER FOR A
DAIRY—DAIRY UTENSILS.

A DAIRY ought, if possible, so to be arranged, that its lattices may never front the south, south-west, or south-east ; and these lattices, which are affirmed to be in every respect superior to glazed lights, may be covered with oiled paper, pasted on pack-thread stretched for that purpose, so as to admit the light, while they will effectually exclude the sun and wind.*

As the greatest cleanliness is requisite in the various departments of the dairy, it will be necessary to have separate apartments in order to perform its business properly. A *Butter dairy* ought to comprise three apartments ; one for receiving the milk, another for performing the operation of churning, and a third for containing and cleaning the various utensils. For a cheese dairy, four rooms will be requisite, viz. a milk room, as before, another for making and pressing the cheese, a third for salting it, and a fourth (which may be commodiously placed as a loft over the others) for storing and preserving them until brought to market. Where a dairy is confined to the sale of milk, two apartments will suffice, one for containing the milk as it is brought in, and another for serving it out, scalding the utensils, &c. These various apartments ought to communicate together : and as it is of material importance that the heat be of one uniform temperature, of from fifty to fifty-five degrees of

* "Bath Papers," Vol. iii.—Lattices in dairies are exempted from the tax on windows, but *not* glazed lights.

Fahrenheit's thermometer, double walls and a roof have been recommended by Dr. Anderson and others, leaving a space of one or two feet (Dr. A. prefers four foot) between the wall and the lath and plaster. Mr. Marshall, to whose practical skill our former pages have borne ample testimony, advises the walls to be constructed six feet thick, one foot on the inside to be of brick or stone, the outside to be of sod, and the intermediate space to be closely filled with earth. The roof, which should be of thatch, should be at least three feet thick, and should project completely over the walls on each side: and as all these materials are non-conductors of heat, Mr. M. is of opinion, that a dairy thus built, would, if provided with double doors, preserve the requisite degree of heat above mentioned, throughout the year. Further, the dairy should be neatly paved with stone, or, if this cannot be procured, with red bricks, laid upon a gentle descent, lest any water should stagnate. It will likewise be proper daily to wash the pavement during summer; and as dairy-houses cannot be kept too cool, it will be of great advantage to build them, if possible, near a cold spring or rivulet.

Further, if a small current could be conducted through the premises, or water were, by means of a pipe, so introduced as to fall from some height on the pavement, it will be of great advantage, as it will contribute much to preserve the air continually pure, fresh, and cool. But, as the milk itself when brought in warm, will naturally tend to raise the temperature of the milk-room too high, it is recommended to have an ice-house attached to the dairy, especially where the advantage of a current of water cannot be obtained. This Dr. Anderson advises, should be surrounded with a double wall, or three sides with an interval between them like the dairy. The place for holding the ice should be formed of upright posts, lined with wattled work of wands or close rail-work, leaving a path all round, of two feet and a half in width: round this is to be formed a gutter to carry off the water dropping from the ice. This mode of constructing an ice-house, Dr. A. pronounces to be not only the cheapest, but also far preferable to the common practice of making cellars under ground, which are both more expensive, as well as liable to mould and rottenness. The structure of an ice-house, attached to a dairy, would prove addi-

tionally profitable if the dairy be situated near large towns; where the ice could be sold during summer.

Where the temperature of the milk-room has become affected by the carrying of newly drawn milk into it, it may easily be reduced to the proper temperature by suspending a small quantity of ice at a considerable height from the floor: and if, during winter, the cold should become too great, a barrel of hot water closely stopped, or a few hot bricks, placed on the floor or table of the milk-room will readily counteract its effects. But on no account whatever should a chaffing-dish with burning coals be used, as it will certainly impart a bad taste to the milk.

The UTENSILS of a Dairy comprise pails, sieves, coolers, churns, creaming-dishes, cheese-vats, ladders, and presses: to these should be added a Fahrenheit's thermometer, which should be suspended in a central part of the milk-house. Wood is the material usually employed, and of which in fact the various utensils ought to be invariably made: lead, copper, or brass utensils, as well as earthenware vessels glazed with lead, ought on no pretext whatever to be used; for the acid which is contained in milk, combines with these metals, and forms a poisonous compound with them. Cast iron, though it does not form a poisonous compound with the milk, is by no means unexceptionable, because it does form a compound that may, in a considerable degree, affect or change the taste and quality of dairy products. Of all metallic dishes those invented a few years since by Mr. Baird, of the Shotts iron-works in Linlithgowshire, are perhaps liable to the fewest objections, as the tin with which they are coated is acted upon by the acetic acid contained in milk in a very slight degree. These vessels are made of cast iron softened by annealing in charcoal, so that they will not break by an ordinary fall, turned smooth in the inside, and laid over with a coat of tin to prevent the iron from coming in contact with the milk. These milk dishes are coming into very general use: and Sir John Sinclair pronounces their invention to be one of the greatest improvements in dairy management. They are stated to be kept more easily clean than wooden vessels: and their superior power of conducting heat cools the milk so rapidly, that the Scottish farmers' wives, who have given them a fair trial, affirm, that they throw up *one third more cream* from an equal quantity of

milk. They are made at the Shotts foundry from half an English quart to twenty-four quarts in content, and vary in price from one shilling to nine shillings and sixpence.*

All dairy utensils ought to be most carefully scoured first with hot water, and afterwards rinsed with cold, and kept in an airy place, in order that every possible degree of acidity may be removed. Should one or two scourings be insufficient, they must be repeatedly cleansed until they become entirely sweet; as the slightest taint or acidity may cause material loss.†

SECTION II.

MANAGEMENT OF MILK AND CREAM.—MAKING AND PRESERVATION OF BUTTER.

THE quality of cows' milk greatly depends on the nature of their food, which likewise materially affects the quantity they will yield; though this last circumstance is, in some measure, regulated by the manner of milking them. It will, therefore, be necessary to be very cautious in choosing milkers; because, if a cow be roughly handled, it is not only painful to her, but will also cause her to withhold her milk, which is often attended with serious consequences; whereas, if it be gently drawn, she will yield that salutary fluid abundantly. As it sometimes happens that cows are *ticklish*, they should, on such occasions, by no means be harshly or severely treated; and if the udder be hard and painful, it ought to be fomented tenderly with luke-warm water, and stroaked gently, by which simple expedient she will be brought into good temper, and yield her milk with pleasure and freedom.

* Sir J. Sinclair on the Husbandry of Scotland, Vol. i. pp. 118, 119.—For many of the preceding hints, as well as for most of the subsequent remarks in this chapter, we are indebted to Dr. Anderson's truly valuable "Essay on the Management of the Dairy," as corrected and inserted in the third and fourth volumes of his "Recreations in Agriculture," new Series, to which we now refer once for all.

† It has been lately found that slate makes very good milk coolers, and in some of the midland counties the common flag slate is employed for the purpose.

In this country, it is the general practice to milk cows twice in the course of twenty-four hours, throughout the year; but, in summer, the proper periods are at least three every day, and at intervals as nearly equidistant as possible, viz. in the morning, at noon, and a little before the approach of night. For it is a fact, confirmed by the experience of those who have tried it, that cows, when milked thrice in the day, will yield more milk in point of quantity, and of as good, if not better, quality, than they will under the common mode of milking only on the morning and evening.

After the milk is drawn from the cow, it should be carefully strained through a linen cloth, or hair sieve, (Dr. Anderson prefers a sieve made of silver wires, on account of its superior wholesomeness), into the cream-dishes, which should never exceed three inches in depth, though they may be made so wide as to contain any quantity required, and which ought to be perfectly clean, sweet, and cool. If any ill flavour is apprehended from the cows having eaten turnips, &c. the addition of one-eighth part of boiling water to the milk, before it is poured into the dishes, will effectually remove it; and, when filled, the dishes ought to be set upon shelves, or dressers, there to continue till the cream is removed.* This should be steadily done by means of a skimming-dish, if possible, without spilling any upon the floor, because it will speedily taint the air of the room, and the cream poured into a vessel, till enough be obtained for churning.

With regard to the process of making butter, we would observe, from Dr. Anderson's valuable Essay, already referred to, 1. The milk first drawn from a cow is always thinner, and inferior in quality to that afterwards obtained; and this richness increases progressively, to the very last drop that can be drawn

* Mr. Young has recommended the dairy-man to boil two ounces of nitre in one quart of water, and to bottle the mixture; of which, when cold, a large tea-cup full is to be added to ten or twelve quarts of milk as soon as it comes from the cow: the quantity of saltpetre is to be increased as the turnips become stronger. The feeding of cows with the roots alone will, as the Earl of Egremont found, prevent the milk from having a bad taste. Another method of removing any ill flavour, arising from the cows having eaten turnips, consists in warming the cream, and afterwards pouring it into a vessel of cold water; from which the cream is to be skimmed as it rises to the surface, and thus the unpleasant taste will be left behind in the water.

from the udder. 2. The portion of cream rising first to the surface, is richer in point of quality, and greater in quantity, than that which rises in the second equal space of time, and so of the rest; the cream continually decreasing, and growing worse than the preceding.* 3. Thick milk produces a smaller proportion of cream than that which is thinner, though the cream of the former is of a richer quality. If thick milk, therefore, be diluted with water, it will afford more cream than it would have yielded in its pure state, though its quality will at the same time be inferior. 4. Milk carried about in pails, or other vessels, agitated and partly cooled before it be poured into the milk-pans, never throws up such good and plentiful cream as if it had been put into proper vessels immediately after it came from the cow.

From these fundamental facts, the Doctor observes, many very important corollaries, serving to direct the practice, may be deduced, among which we can only notice the following:

I. It is evidently of much importance, that the cows should be always milked as near the dairy as possible, to prevent the necessity of carrying and cooling the milk before it be put into the dishes; and as cows are much hurt by far driving, it must be a great advantage in a dairy-farm to have the principal grass fields as near the dairy or homestead as possible. In this point of view, also, the practice of feeding cows in the house, rather

* The following method of preparing cream, which is peculiar to the counties of Somerset, Cornwall, and Devon, is too interesting to be omitted, although attempts to form it in other parts of Great Britain, it is affirmed, have been hitherto unsuccessful. The milk, when 24 hours from the cow, is put into a kettle over a slow fire, which should be hot enough to bring it *very near* to the boiling point in about *two hours*, and not less. A person (usually a child) is set to watch it; and, the moment a bubble rises to the top, formed by the vaporized milk, the whole is taken off, and set to rest for 24 hours more. At the end of this time, if the quantity of milk be considerable, the cream will be an inch or more thick upon the surface. It is now divided with a knife into squares of a convenient size, and removed. The milk, remaining after the cream is taken off, contains little beside the watery particles in its original composition. The dairy-women, in the above-mentioned counties, say that milk, thus treated, will yield *one-fourth* more butter than is produced in the common way, and that a few strokes of the churn will form such cream into excellent butter. At present this cream is chiefly confined to the breakfast-table: it is excellent for use with coffee, but when put into tea, it injures its taste, by being instantly converted partially into butter which rises to the surface. Cream, prepared as above, will keep somewhat longer than common cream.

than turning them out to pasture in the field, must appear to be obviously beneficial.

II. The practice of putting the milk of all the cows of a large dairy into one vessel, as it is milked, there to remain till the whole milking be finished, before any part is put into the milk-pans, seems to be highly injudicious, not only on account of the loss sustained by the agitation and cooling; but also, and more especially, because it prevents the owner of the dairy from distinguishing the good from the bad cow's milk, so as to enlighten his judgment respecting the profit that he may derive from each. Without this precaution, he may have the whole of his dairy-produce greatly debased by the milk of one bad cow, for years together, without being able to discover it. A better practice, therefore, would be, to have the milk drawn from each cow separately, put into the creaming-pans as soon as milked, without being ever mixed with any other; and if these pans were all made of such a size as to be able to contain the whole of one cow's milk, each in a separate pan, the careful *dai** would thus be able to remark, without any trouble, the quantity of milk afforded by each cow every day, as well as the peculiar qualities of the cow's milk. And if the same cow's milk were always to be placed on the same part of the shelf, having the cow's name written beneath, there never could be the smallest difficulty in ascertaining which of the cows it would be the owner's interest to dispose of, and which he ought to keep and breed from.

III. If it be intended to make butter of a *very fine quality*, it will be advisable, not only to reject entirely the milk of all those cows which yield cream of a bad quality, but also, in every case, to keep the milk that is first drawn from the cow, at each milking, entirely separate from that which is got last; as it is obvious, if this be not done, the quality of the butter must be greatly debased, without much augmenting its quantity. It is also obvious, that the quality of the butter will be improved in proportion to the smallness of the quantity of the last-drawn milk which is used, as it increases in richness to the very last drop that can be drawn from the udder at that time; so that those who wish to be singularly nice, will do well to keep for

* A provincial word, denoting the person who has the chief concern in a dairy.

their best butter a *very small* proportion only of the last-drawn milk.

It is a matter of some importance, to determine in what way the inferior milk, which is thus set apart when *fine* butter is wanted, can be employed with the greatest profit. In the Highlands of Scotland, the people have adopted a practice, merely from considerations of convenience and economy, without thinking of the improvement of the butter, which answers many good purposes. As the rearing of calves is there a principal object with the farmer, every cow is allowed to suckle her calf with a portion of her milk, the remainder only being employed for the purposes of the dairy. To give the calf the proportion allotted to it regularly, it is separated from the cow, and put into a small inclosure made for the express purpose, on every farm, of confining all the calves belonging to that farm. At regular times the cows are brought to the door of this inclosure, where the young ones fail not to meet them. Each calf is then separately led out, and runs directly to its mother, where it is allowed to suck till the dairy-maid judges that it has had enough; it is then separated, the legs of the mother having been previously shackled, by a very simple contrivance, to oblige her to stand still, and the dairy-maid milks off what was left by the calf. They proceed in this manner till the whole of the cows are milked, and thus do they obtain a small quantity of milk, it is true, but that of an exceedingly rich quality; which, in the hands of such as know how to manage it, is manufactured into the richest marrowy butter that can be any where met with. This richness of the Highland butter has been long remarked, and has been universally ascribed to the old grass that the cows feed upon in those remote glens; but it is in fact chiefly to be attributed to the practice here described, which has long prevailed in those districts.

Other secondary uses might be found for the milk of inferior quality. It might be converted into butter of a secondary quality; or might be sold sweet, where the situation of the farm is within reach of a town; or it might be converted into cheeses, which, by being made of sweet milk, if made with care and skill, might be of a fine quality.

With respect to the operation of churning,* we would par-

* For descriptions and figures of useful churns, see Chap. V. Sect. VIII. pp. 274—277.

ticularly remark, that it ought to be regularly continued, till the butter is *come*, or formed; nor, unless from absolute and irremediable necessity, should any assistant be allowed to churn; because, if the motion be, in summer, too quick, the butter will in consequence ferment and become ill tasted; and, in winter, it will *go back*.* The business of churning may, however, be much facilitated, by immersing the pump-churn (if such be employed) about one foot deep into a vessel of cold water, and continuing it there till the butter is made. Where other churns are made use of, the addition of one or two table-spoons full of distilled vinegar, after the cream has been considerably agitated, will, it is said, produce butter in the course of an hour. After the butter is formed, the usual practice is to wash it in several waters till all the milk is removed; but Dr. A. advises the milk to be forced out of the cavities of the butter by means of a flat, wooden ladle, furnished with a short handle, at the same time agitating the butter as little as possible, lest it become tough and gluey. The beating of butter up by the hand is an indelicate practice, particularly if it be constitutionally warm; and, as it is hurtful to the quality of the butter to pour cold water on it during this operation, the butter, if too soft to receive the impression of the mould, may be put into small vessels, and these be permitted to float in a trough of cold water beneath the table, *without wetting the butter*, which will soon become sufficiently firm. Or, when butter is first made, after as much of the milk has been got out as possible, it may be thinly spread on a marble slab, and the remaining moisture be absorbed by patting it with clean dry towels.

Butter, thus freed from the remaining milk, is called *fresh butter*: and, when sold on the spot, or in neighbouring markets, it is formed into rolls weighing half a pound or a pound, or into lumps of 24 ounces, termed *dishes* in Somersetshire and some other parts of England. But where it is intended to be kept, or sent to a distance, it is salted by the process immediately to be described, and is put into casks, which contain respectively 28, 56, or 84 lbs., and usually denominated half firkins, firkins, and tubs. Previously to putting the butter into these vessels, especial care must be taken that they be well

* Soap, mischievously slipped into a churn, will prevent the cream from making butter. Bath Papers, Vol. III, p. 309.

seasoned by frequent washing and exposure to the air for two or three weeks. As it is very difficult to season *new* firkins, it will always be preferable to employ those which have been already used, where these can be returned to the dairy-owner. The most speedy method of seasoning firkins is, by the use of unslaked lime, or a large quantity of salt and water well boiled; with which they should be repeatedly scrubbed, and afterwards thrown into cold water, to remain there three or four days till wanted. They should then be scrubbed as before, and well rinsed with cold water; and, before the butter is put in, *every part* of the inside of the firkin must be well rubbed with salt.

The ordinary process of salting butter, after the milk has been forced out of it in the manner already described, is, to work into the butter one or two ounces of salt, so thoroughly that it shall be equally incorporated with the mass. The salt employed for this purpose should be of the purest kind, well dried and broken down, but not completely pulverized. Dr. Anderson, however, recommends the following preparation, which he has experienced to be much superior, as it not only prevents the butter from becoming in any degree tainted or rancid, but also improves its look or appearance, while (what is of more importance) it imparts a sweeter and richer taste than could have been effected by the use of common salt only. Let two parts of the best common salt, sugar and saltpetre of each one part, be completely blended together by beating, and add one ounce of this mixture to every pound of butter, incorporate it thoroughly in the mass, and close it up for use. It will be necessary, however, to keep butter, thus prepared, for two or three weeks before it is used, otherwise it will not taste well; but, if properly cured according to the hints above given, Dr. A. states, that it will continue so perfectly sweet for three years, as not to be distinguished from newly-made and salted butter. The best butter is that made during the summer; but by adding a certain portion (which experience only can determine) of the juice expressed from the pulp of carrots to the cream previously to churning, winter-made butter will acquire the appearance and flavour of butter that has been churned during the prime part of the summer season.

When butter is to be exposed to the heat of a warm climate, it should be purified by melting, before it be salted and packed up. For this purpose, Dr. Anderson directs it to be put into a

proper vessel, and this into another containing water, which must be gradually heated until the butter be thoroughly melted. In this state it must continue for some time, when the impure parts will subside, and leave at the top a perfectly pure transparent oil; which, on cooling, will become opaque, and assume a colour nearly resembling that of the original butter, except that it will be a little paler and of a firmer consistence. This refined butter is then to be separated from the dregs, salted, and put up in the same way as the other butter: it will continue much longer sweet in hot climates, as it retains the salt better. Dr. Anderson further states, that butter may be preserved sweet without salt, by adding a certain quantity of fine honey, in the proportion of one ounce of the latter to a pound of butter, and mixing them thoroughly, so that they may be perfectly incorporated. A mixture of this sort has a sweet pleasant taste, and will keep for years without becoming rancid.

In different counties there are several variations in the making of this primary article of domestic consumption; but as the hints and cautions already stated are, we trust, sufficiently calculated for general purposes, it would unnecessarily swell this work to state them; we therefore pass to

SECTION III.

OF THE MAKING AND PRESERVATION OF CHEESE.

THE goodness of cheese, as well as of butter, depends much on the quality of the milk; though the season, and particular process adopted in making it, also, have a very considerable influence upon it in this respect—more perhaps than the material of which it is prepared. We shall, therefore, briefly notice these circumstances; and, as different modes of making cheese are practised in different counties or places, we shall then concisely state those which are more particularly deserving of notice.

The best season for this purpose is, according to Mr. Donald-

son, from the commencement of May till the close of September; or, under favourable circumstances, till the middle of October; during which interval cows are, or can, in general be pastured. In many large dairies, indeed, cheese is often manufactured all the year round; but the winter cheeses are much inferior in quality to those made during the summer months; though there is no doubt but that good cheese may be made throughout the year, provided the cows be well fed, particularly in the winter.

With regard to the *rennet*, as no good cheese can be made without it, great attention is necessary in preparing it for coagulating the milk. Strictly speaking, rennet is the coagulated lacteous matter, or substance, found in the stomachs or maws of calves that have been fed only with milk, and which was formerly used in coagulating milk; though it is, in a more extensive sense, applied to the *bait*, *vell*, *maw*, or *stomach*, as it is variously termed, which possesses the same properties; and which is now invariably used for that purpose.

Dairy women usually preserve the maw, and the curd contained in it, after salting them, and then, by steeping this bag and curd, make a rennet, to turn their milk for making cheese. But a more simple method, and which is equally good in every respect, is to throw away the curd, and, after steeping it in pickle, stretch out the maw upon a slender bow inserted into it, which will soon be very dry, and keep well for a long time. Take an inch or two of the maw thus dried, and steep it overnight in a few spoonsfull of warm water, which water serves full as well as if the curd had been preserved for turning the milk. It is said, that one inch will serve for the milk of five cows.

An ingenious writer, who has made strict inquiry into this subject, recommends the following method of preparing a rennet, which he has found to be better than any other:—"Throw away the natural curd, which is apt to taint and give the bag a bad smell; then make an artificial curd, or rather butter, of new cream, of sufficient quantity to fill the bag. Add three new-laid eggs well beaten, one nutmeg grated fine, or any other good spice; mix them well together, with three tea-cups full of fine salt; fill the rennet-bag with this substance, tie up the mouth, lay it under a strong brine for three days, turning it over daily. Then hang it up in a cool and dry place for six

weeks, and it will be fit for use. When it is used, take with a spoon out of the bag a sufficient quantity of this artificial butyrous curd for the cheese you purpose to make, dissolve it in a small quantity of warm water, and then use it in the same manner as other rennet is, mixed with the milk for its coagulation."

But, whatever kind of rennet the dairy-woman may choose to prepare, it should be remembered, that this animal acid is extremely apt to become rancid and putrescent, and that great care is necessary to apply a sufficient quantity of salt to preserve it in its best state; because the rank and putrid taste, occasionally found in some of our English cheeses, is owing to a putridity in the *rennet*. The following mode of preserving it in a sweet state, as practised in the West of England, may not be undeserving of attention. When the rennet-bag is fit for the purpose, let a strong solution of salt be made with two quarts of sweet soft water, and add to this small quantities of almost every indigenous and foreign aromatics and spices that can be obtained. Boil the whole gently, till the decoction is reduced to three pints, over a clear fire, if possible, or at all events, so that it may not become smoky; next, let the liquor be carefully strained, and poured, in a tepid state, upon the rennet-bag. A lemon may now be sliced into it; and, after the whole has stood at rest for one or two days, it may be strained and bottled. If well corked, it will retain its goodness for a year, or even longer, and will communicate an agreeably aromatic flavour to the cheese that may be made with it. In a case of emergency, or where no good rennet can be procured, a decoction of the yellow flowers of the *cheese-rennet*, or yellow lady's bed-straw (*Galium verum*, L. which blossoms in July and August), will answer every purpose for coagulating milk. Or, the marine acid in the hands of a judicious person, may be employed for this purpose, as is practised in Holland.

Cheshire cheese. The evening's milk is set apart till the following morning, when the cream is skimmed off, and poured into a brass pan heated with boiling water, in order to warm: one-third part of that milk is thus heated. The new milk, obtained early in the morning, and that of the preceding night, being thus prepared, are poured into a large tub, together with the cream. To this is put a piece of rennet, which had been kept in warm water since the preceding evening, and with which

a little Spanish arnatto (the weight of a guinea and a half is enough for a cheese of sixty pounds) is rubbed fine and mixed. The whole is now stirred together, and covered up warm for about half an hour, or till it becomes curdled; it is then turned over with a bowl, to separate the whey from the curd, and shortly after broken very small. After standing a little time the whey is taken from it, and the curd sinks to the bottom where the whey is expressed from it; as soon as the curd becomes a little more solid, it is cut into slices and turned over repeatedly, to express all the remaining whey, and is again pressed with weights. Next, the curd is removed from the tub, broken by hand into small pieces, in which state it is termed *gurth* in North Britain, and put into a cheese-vat, where it is strongly pressed both by hand and with weights, in order to extract the remaining whey. After this it is transferred to another vat, or into the same, if it be previously well scalded, where the same process of breaking and expressing is repeated, till all the whey is squeezed from it. The cheese is now turned into a third vat, previously warmed, with a cloth beneath it, and a tin hoop or binder put round the upper edge of the cheese, and within the sides of the vat, the former being previously inclosed in a *clean* cloth, and its edges placed within the vat. These various processes occupy about six hours, from seven o'clock in the morning till one in the afternoon. Eight hours more are requisite for pressing the cheese, which, during that time, should be twice turned in the vat, around which are passed thin wire skewers, and frequently shifted. The following morning and evening it must be again turned and pressed; and also on the third day, about the middle of which it is removed to the salting chamber, where the outside is well rubbed with salt, and a cloth binder passed round it. Here the cheese is for nearly a week turned about twice in the day, then left to dry for two or three days, during which period it is turned once, and cleaned each day. Lastly, it is deposited in the cheese or store room, (which ought to be moderately warm, and sheltered from the access of air, lest the cheese should crack,) and turned every day, till it become sufficiently hard and firm.*

* The cheese-rooms in Cheshire are generally placed over the cow-houses on a floor strewed with rushes. This is done, in order to afford them, from the heat of the cattle below, that uniform and moderate degree of temperature, which is deemed essential to the proper ripening of cheese.

The Dutch make their cheese nearly in the same manner, excepting that they substitute the marine acid, or spirit of sea-salt, which imparts to Dutch cheese the peculiarly sharp and salt flavour for which it has long been remarked.

Dunlop cheese is made partly in the parish of Dunlop, and in places in its vicinity, in the county of Ayr, of various sizes, from twenty to sixty pounds.—After the milk is brought to a certain degree of heat, (about 100 degrees of the thermometer upon an average, though in summer ninety will be sufficient, as, on the contrary, during winter, a higher degree will be requisite,) it is poured into a large vessel, where the rennet is added to it, and which is closely covered up for a short time, perhaps ten or twelve minutes. If the rennet be good, it will have effected a coagulation of the milk, which is gently stirred, when the whey begins immediately to separate, which is taken off as it gathers, until the curd become tolerably solid. It is then put into a *drainer*, (a vessel made for the purpose, the bottom of which is perforated with small holes,) and the cover of which is pressed down with any convenient weight. After it has thus stood for some time, and is pretty dry, it is returned into the first vessel or dish, where it is cut into very small pieces by means of a cheese-knife, (which is furnished with three or four blades, fixed on prongs from the handle, that cut in a horizontal direction,) it is then salted, and properly mixed by the hand. Lastly, it is put into a *cheesitt*, or stout dish with iron hoops, which has a cover that goes exactly into it: a cloth being placed between the curd and the vessel. In this state it is submitted to the action of the cheese-press, when it is occasionally taken and wrapped in dry cloths, till it has completely parted with the whey. When this is suspected to be the case, the cheese is laid aside for one or two days, when it is again examined; and, if there be any appearance of whey remaining, the pressure and application of cloths are repeated. As soon as it is ascertained that the whey is extracted, the cheese is laid out, either on boards made for the purpose, (and which are or should be of the same breadth as the cheese), or on a deal floor or boards, as well as to notice whether any whey runs from them, because no cheese will keep well while any whey remains. Besides, if that part sours, the whole cheese will acquire a disagreeable flavour and smell; or, if an immoderate quantity of rennet be used, it will produce similar effects, and

also blow up the cheese full of small holes; which last effect will also result from suffering the cheese to continue too long on one side. After the cheese is cured, various modes are adopted in polishing them for sale, which are rather injurious than beneficial; nothing farther being requisite, besides turning them, than to rub them occasionally with a coarse cloth, especially after harvest, because at that time they tend to breed mites.*

Gloucester cheese. In making this sort of cheese, the milk is poured into the proper vessel, immediately after it has been drawn from the cow; but being thought too hot in the summer, it is lowered to the due degree of heat by the addition of skimmed milk; or, if that will not do, by pouring in water. When the curd is come, it is broken with a double cheese-knife, and also with the hand, to separate it from the whey which is laded off. The curd is then put into vats, which are submitted to the action of the press for ten minutes or a quarter of an hour, till the remaining whey is extracted. It is next removed into the cheese-tubs, again broken small, and scalded with a pailfull of water, lowered with whey in the proportion of three parts of water to one of whey, and the whole is briskly stirred. After standing a few minutes for the curd to settle, the liquor is strained off, and the curd collected into a vat, and, when the latter is about half full, a little salt is sprinkled over and worked into the cheese. The vat is now filled up, and the whole mass of cheese turned twice or thrice in it, the edges being pared, and the middle rounded up at each turning. Lastly, the cheese is put into a cloth, and, after undergoing another pressure, it is carried to the shelves, where it is turned, in general, once a day, till it become sufficiently close and firm to admit of its being washed.

Stilton cheese is made by putting the night's cream to the milk of the following morning with the rennet; and as soon as the curd is come, it is taken out *whole* and put into a sieve, gradually to drain. While it is thus draining, it is pressed till it become dry and firm, and is then removed into a wooden box or hoop, adapted to its size; this sort of cheese being so very rich, that it would separate or fall to pieces were not this precaution adopted. Afterwards it is turned every day on dry

* Farm. Mag. Vol. iv. p. 381.

boards, cloth binders being tied round it, and which are made tighter as occasion may require. After it is removed from the box or hoop, the cheese is closely bound with cloths, which are changed daily, till it become sufficiently compact to support itself; when these cloths are taken away, each cheese is rubbed over every day once (and if the weather be moist or damp, twice,) for two or three months, with a brush, which is also done every day to the tops and bottoms of the cheeses before the cloths are removed. This kind of cheese is termed *Stilton* from the town where it is chiefly sold, and is made in the counties of Northampton, Rutland, and Huntingdon. Sometimes it is made in a net like a cabbage net, which gives it the form of an acorn. *Stilton* cheeses are not sufficiently mellowed for use, until they are two years old; and will not sell unless they are decayed, blue, and moist. In order to accelerate their maturity, it is no uncommon trick to place them in buckets, and cover these over with horse-dung. Wine is also said to be added to the curd, in order to produce a rapid advance of ripeness in cheese.

Skim cheese is chiefly made in the county of Suffolk, whence it is sometimes called Suffolk cheese. The curd is broken in the whey, which is poured off as soon as the former has subsided; the remaining whey, together with the curd, being thrown into a coarse strainer, and exposed for cooling, is then pressed as closely as possible. It is then put into a vat, and pressed for a few minutes, to extract the remaining whey. The curd being thus drained from the whey, is taken out, again broken as finely as possible, salted, and submitted to the press. The other operations do not materially vary from those adopted in other cheese-making districts. The Suffolk cheese forms, in general, part of every ship's stores, because it resists the effects of warm climates better than others; but it is, Dr. Anderson observes, remarkable for "a horny hardness and indigestible quality."

Cream cheese is generally made in August or September, the milk being at that time richer and fatter than at other periods of the year. Not having the warm season to ripen it, this kind of cheese is generally made somewhat thick in order to preserve its mellowness. Cream cheeses are more liable than the leaner sorts to accidents, owing to chillness, or the being frozen before they become hard: for when frost once penetrates a cheese, it destroys every good quality, and generates putrefac-

tion, or makes it become either insipid or ill tasted. Hence this kind of cheese should always be kept in a warm situation, and be particularly guarded against frost, and till it has sweated well; otherwise all the advantage of its rich quality will be completely lost.*

In making *Wiltshire cheese* (which is admitted to be among the best English sorts) the milk is "run" as it is brought from the cow; or if it be of too warm a temperature, it is lowered by the addition of a little skimmed milk. The curd is, in the first place, broken with the hand to various degrees of fineness, according to the sort of cheese intended to be made. Thus, for *thin* cheese, it is not reduced so fine as in the county of Gloucester; for the *thick* kind, it is broken still finer; and for *loaves* it is almost crushed to atoms. But, in first breaking the curd, care is taken to let the whey run off gradually, lest it should carry away with it the "fat" of the cowl. As the whey rises it is poured off, and the curd pressed down; after this it is pared, or cut down, three or four times, in slices, about one inch thick, that all the whey may be extracted, and is then scalded in the same manner as Gloucester cheese. In some dairies it is the practice, after the whey is separated, to re-break the curd and salt it in the "cowl;" but in others, it is taken, while warm, out of the liquor and salted in the vat. The thin sorts are disposed, with a small handfull of salt, in one layer; thick cheeses, with two handfull of salt, in two layers; and loaves, with the same quantity, in three or four layers; the salt being spread, and uniformly rubbed among the curd. In general, Wiltshire cheese is twice salted in the press beneath which it continues, according to its thickness; the thin sorts three or four "meals," thicker ones four or five, and *loaves* five or six.

Green cheese is made by steeping over night, in a proper quantity of milk, two parts of sage with one of marigold leaves and a little parsley, after being bruised, and then mixing the curd thus *greened*, as it is termed, with the curd of the white milk. These may be mixed irregularly or fancifully according to the pleasure of the maker. The management is in other respects the same as for common cheese. Green cheeses are chiefly made in Wiltshire.

* "Twamley on Dairying," p. 64.

These are the kinds of British cheese in most general esteem; the other sorts, together with foreign cheeses, being too numerous to admit of a detail in our already-protracted work: we shall, therefore, conclude with observing, that cheese should be kept in an airy place, and that if the moderately-dried leaves of the tutsan, or park leaves, as it is provincially termed (*Hypericum Androsæmum*, L.); or, of the yellow star of Bethlehem, (*Ornithogalum luteum*, L.): or, if the young twigs of the common birch-tree be placed on the surface or sides of cheeses, they will, especially the tender branches of the birch, be found very serviceable in preventing the depredations of mites. Sometimes, however, it happens that cheese will *hove* or swell, either from some accident, or from inattention in some part of the process. To prevent, as likewise to stop, this hoving, it has been recommended to lay such cheeses in a moderately cool, dry place, and regularly to turn them. Whenever any one becomes considerably swollen, it will be requisite to prick it on both sides in several places, particularly where it is most elevated, by thrusting a large awl, pin, &c. pretty deeply into it; repeating this as often as may be necessary. And though the pricking, it is observed, will not altogether prevent the swelling, yet it will, by giving a passage to the confined air, render it less considerable; and the cavities of the cheese will neither be so disagreeable, nor consequently so unsightly or unpleasant to the eye.

Throughout the system of dairy management, the vigilant eye of the principal ought carefully to pervade; as it rarely happens that servants are to be found who will give that minute attention to every particular, which is so indispensably necessary to insure success. On this account, it is more likely that a dairy farm of moderate size,—one for instance, that will keep ten or twelve cows, will, *if well managed*, afford more profit than one of a greater extent: because, in the former case, the farmer's wife (and daughters if he have any) can more easily superintend, or perhaps perform a considerable part of the dairy operations themselves: and this is always better done by them than we can ever expect it to be by hired servants. No branch of husbandry, in fact, deserves and requires such

unremitting attentions.—“ If,” Sir John Sinclair very justly remarks, “ a few spoonfuls of milk are left in the udder of the cow at milking ; if any *one* of the implements used in the dairy be allowed to be tainted by neglect ; if the dairy-house be kept dirty, or out of order ; if the milk is either too hot or too cold at coagulating ; if too much or too little rennet is put into the milk ; if the whey is not speedily taken off ; if too much or too little salt is applied ; if the butter is too slowly or too hastily churned ; or if other minute attentions are neglected, the milk will be in a great measure lost. If these *nice operations* occurred only once a month, or once a week, they might be easily guarded against : but, as they *require to be observed during every stage of the process, and almost every hour of the day*, the MOST VIGILANT ATTENTION must be kept up throughout the whole season. That is not to be expected from hired servants. The wives and daughters of farmers, therefore, having a greater interest in the concern, are more likely to bestow that constant, anxious, and unremitting attention to the dairy, without which it cannot be rendered productive.”*

* Sir J. Sinclair on the Husbandry of Scotland, Vol. ii. p. 124.

A P P E N D I X.

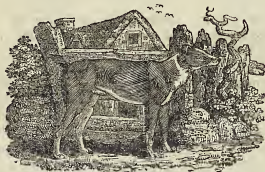
I. OF THE DOG.

AMONG the various animals which the benevolent hand of Providence has bestowed for the use of mankind, the Dog deservedly holds a distinguished rank, on account of his sagacity, docility, fidelity, and affection for his master. To omit the numerous varieties of these useful animals, which are kept either for the purpose of show, hunting, or amusement, we shall now call the reader's attention to two kinds, that are peculiarly useful to farmers, graziers, and all indeed who have any thing to do with the keeping or management of cattle.



The *Shepherd's Dog*, which is delineated in the preceding cut, occurs chiefly in the extensive sheep-walks in the northern parts of this island, where the purity of its breed appears to be preserved in the greatest perfection. Its docility and sagacity, indeed, surpass those of every other variety of the canine race: obedient to the voice, looks, and gestures of his master, he quickly perceives his commands, and instantly executes them. A well-trained dog of this kind is, to a shepherd, an invaluable

acquisition. The faithful animal anxiously watches the flock, keeps them together in the pasture, from one part of which it conducts them to another; and, if the sheep are driven to any distance, a well-trained dog will infallibly confine them within the road, and, at the same time, prevent any strange sheep from mingling with them. Should, however, any straggle from the road, he will pursue them, and drive them to the flock, without hurting them in the slightest degree.



The *Cur Dog* is a distinct species, which of late years has become singularly valuable to farmers and breeders of cattle. He is, in general, of a darker colour, and also stronger, more fierce, and larger than the shepherd's dog; to which he is often superior in sagacity. This kind knows its master's fields, where it watches the cattle with peculiar vigilance, regularly going its rounds; and, if any strange beasts appear among them, it compels these speedily to withdraw. The colour of this species is, in general, black and white, with half-pricked ears; they bite very keenly; and, contrary to the habit of many dogs, they constantly attack cattle at their *heels*, which is an advantage; not only in exposing beasts the less to *laceration*, but also in depriving these of any defence against the dogs; so that they become peculiarly useful in driving cattle.

Dogs live, in general, to the age of fourteen or fifteen years, but rarely survive twenty. The female breeds during the first

year, and usually brings forth from six to twelve puppies, after a gestation of about nine weeks : small-sized dogs, however, whelp five, four, and sometimes only two. The puppies are mostly blind for ten or twelve days ; they also lose some of their teeth when about four months old, but these are quickly succeeded by others.

Beside the two varieties above described, there is a mongrel breed, possessing several qualities of the cur, shepherd's dog, grey-hound, and mastiff. It is usually found in the possession of drovers, to whom it is particularly serviceable in driving cattle to the slaughter, both by its sagacity, as well as by its superior strength and swiftness ; qualities which are indispensably necessary for the long journeys they not unfrequently have to travel.

In Prussia, there is a peculiar breed of dogs employed in the management of sheep : it is described by M. Lasteyrie as totally different from the shepherd's dogs usually found in France, being of a small size, but stout and thick, with erect ears. The Prussian dogs bear some resemblance to our wolf-dogs : their coats are partly smooth and close, while others are long and shaggy. They are remarkably docile ; *never bite the sheep* ; and, at their master's voice, repair instantly towards that part of the flock which is pointed out : in case the sheep hang behind, *these dogs push them forward with their muzzles* ; which is sufficient to make the sheep take the requisite direction.* An importation, if it could be effected, of a few of this breed would certainly be worth the trial : particularly if the Prussian mode of teaching them, so as not to *bite*, could be acquired. It is, indeed, a most desirable object, that our shepherds should never accustom their dogs to bite sheep ; as these naturally timid animals are afraid at the approach of a dog, often crowd together, and wound one another. The continual state of fear in which they are, particularly where a dog has not been properly trained, disturbs their repose, and prevents them from feeding quietly, which is further very injurious to their health, and consequently to the interests of the sheep-master ; and, in fact, it rarely happens in any flock, that there are not some sheep which are from time to time lacerated, more or less severely, by the bite of dogs.

* Lasteyrie, p. 192.

II. OF THE HORSE.

In the former part of this work, an inquiry was instituted concerning the long-contested point,* whether oxen or horses are preferable on farms; and, notwithstanding the superiority of the former was, we trust, fully evinced, yet, as there are some few situations, and some branches of rural labour, in which horses may be advantageously employed, we shall here state some particulars relative to the best modes of rearing and treating them.

In a wild state, the horse is, in general, of an inelegant form, and extremely intractable; but, when domesticated, he becomes docile, yet bold and intrepid, and is highly attached to man. In breeding, or selecting horses for rural labour, attention must be paid to strength, soundness of constitution, hardiness, activity, and true draught.

As the different varieties and kinds of horses, employed in various parts of this island, are described in the Introductory View of Breeds,† we shall at present only remark, that the Clydesdale or Lanarkshire horses, on account of their singular hardiness, and generally easy purchase, are preferable for elevated or hilly places; while the Cleveland bays (which are reared principally in the counties of Durham, York, and Northumberland,) are best calculated for work requiring much effort and dispatch; and the Suffolk punches are well adapted for long-continued exertion; being, like the Clydesdale horses, both hardy and of easy purchase.

The *breeding of horses*, as a distinct concern, can only be carried on, with any prospect of success, in those districts where a farm comprises an extensive tract of coarse pasturage, which cannot be advantageously appropriated to the fattening or grazing of cattle. Of this description are part of the North Riding of Yorkshire, the fens in the county of Lincoln, and some of the midland counties. In such case, the same attention must be paid to symmetry of form, purity of breed, and individual excellence, as in breeding cattle in general. But the attention in this case should not, as is too commonly practised, be confined to the stallion. So far as experience has

* See pp. 61—68, *supra*.

† Ibid. pp. 16—22, *supra*.

hitherto shown, it has in most instances been found that more depends upon the mare than upon the horse, in regard to the form and other good qualities of the progeny. It is always of importance to select a stallion as similar in form and colour as possible to those of the mare; as, by this practice there is the greater probability that the foal will possess the joint properties both of the sire and dam, and will turn out more agreeably to the wishes of the owner than when more violent crosses are attempted. If, for instance, a mare be put to a great heavy clumsy cart-horse, or *vice versâ*, the stock will prove to be a kind of mongrel breed, rarely possessing in any considerable degree the strength or size of the one, or the spirit, activity, and fine bone of the other.

The STALLION or horse, ought to be bold and spirited, well made, and of a kindly disposition; his constitution should be strong, and free from every kind of disease, and his temper good. With respect to the properties of a good BREEDING MARE,—she should be well shaped, of a gentle disposition, and should have a large body proportioned to her height: she should also be pretty full-bellied, and likely to become a good nurse, or to have plenty of milk. A mare intended to supply the team with draught-colts ought to have large limbs, close joints, a short neck, and a wide chest, with a capacious body. Her eyes should be very clear and full; her nostrils large and open; her temper gentle and tractable; her constitution healthy and vigorous, and altogether free from blemishes, whether hereditary or acquired: for on the good qualities and strength of constitution, united in the sire and dam, in a great measure, depend the future health, strength, and usefulness of the colt.

The mare produces one foal after a gestation of about eleven months: the time of putting her to the horse varies from April to May—the earlier in the spring the better; because it will prove of much moment to have the foal dropped in the close of January, or, at all events, in the course of February.

While breeding, mares may be gently but carefully worked, in order to keep them in health by proper exercise; and they should likewise be kept in good heart, as their offspring will otherwise be weak or unhealthy. After the foals are dropped, the mares ought likewise to be kept in prime condition, that the young animals be not stunted in their growth for want of

a sufficient supply of milk. During the first summer, they may be allowed to run with their dams until Michaelmas, or even longer, if the weather continue open and mild. They should then be weaned and kept in a stable, with low racks and mangers for receiving their food; which ought, at first, to be the sweetest hay that can be procured. Where rouen, or after-math, can be commanded, it will furnish a succulent and invigorating article of food; but both with hay and rouen, bran, oats, or pollard should be given in due proportions, which indeed can only be ascertained by experience. Where, however, oats form a part of the food of horses, especial care should be taken to see that these actually receive the grain: and, with respect to colts in particular, it has been recommended to bruise, or crush them previously in a mill; which necessary precaution will prevent the distention of the lower jaw veins, which would otherwise attract the blood and humours down into the eyes, and thus occasion blindness. Further; by feeding colts with oats, in conjunction with other articles, another benefit will result, viz. that their legs grow broader, and become better knit than when they are fed only with bran and hay, while they will also be enabled to endure greater fatigue.

Colts should be carefully kept from wet and cold, as their tender frames would receive material injury from either. During fine weather they may be turned out into a dry, sweet pasture, (where pure water can be obtained for them to drink at pleasure), for a few hours, and should then be conducted to the stable. Thus they will acquire a habit of docility; and, when broken in for the saddle or for labour, will work quietly: the proper time for this purpose may be from two years and a half to three years of age.

No horse should be less than four years old, that is intended to propagate the species; nor should any mare be allowed to breed after eighteen, or any stallion be kept for that purpose longer than eighteen or twenty years, as they are then only fit for the harness. Castration is commonly performed when the colt is twelve or eighteen months old; but the more general practice is, to defer that operation until the animals are at least two years old, when they will retain a greater degree of strength and spirit. It ought, however, to be observed, that some experienced breeders perform the operation of gelding

when the foal has attained the age of three months, on account of the comparatively less danger of inflammation in young animals. When the mares bring forth early, the close of May or beginning of June has been thought a proper season, if the weather be not too warm.

The feeding of horses (whatever number may be employed) is an object of great importance, on account of the heavy expense of corn-feeding. With a view to reduce this, it has been proposed to soil them with lucerne, tares, or clover, instead of turning them out to grass during the summer; and experience has proved this method to be very beneficial; for, if they be well littered, the manure thus obtained will nearly repay the expense of their maintenance. Further: in order to diminish the charge of corn-feeding, beer or blegg, and carrots, have been advantageously employed as a winter-food in lieu of oats and barley. The practice of using carrots originated, we believe, in the county of Suffolk, whence it has spread through various parts of England. Carrots, indeed, are not only cheaper, but in every respect more wholesome than oats, and infallibly recover broken-winded horses, unless the disease has, from long neglect, or injudicious management, become incurable. Where, however, grain is used, the most economical method is to boil it and give it to the horse, in a cool state, with the liquor; giving in the course of the day a due proportion of hay. A considerable reduction may likewise be made, by cutting the hay or straw into chaff before it be given them; with a small quantity of which, together with a few carrots, horses have been kept through the winter on *steamed potatoes*, with very great success. Forty-two pounds of steamed potatoes with cut chaff will serve a horse for twenty-four hours: and not only will the expense of their keep be diminished, but also their general health will be improved. The bruised tops of furze, where these can be conveniently and early procured, will also effect a considerable saving in the articles of hay and oats; and, at the same time, afford to the animals a grateful food. In many situations it is a common practice to turn horses loose upon commons to feed: but this is a pernicious practice, and exposes them to numerous maladies. In wet seasons they get full of bolts or small needle worms, or, in dry summer, of sand, both of which prove fatal sooner or later to these useful animals.

Of equal importance with the feeding of horses is the management of them, when their daily labour is performed; but concerning the best mode of doing this a considerable difference of opinion prevails. By some it is remarked, that the keeping of horses in stables, with separate stalls for each, so that they may feed quietly and be expeditiously harnessed, is, in every respect, the most preferable method; provided a free current of air pass through the stables. Others, on the contrary, assert that sheds open to the front, with racks and mangers fixed below, and having a pump and cistern, as well as a small yard, in which they may run at pleasure, are superior to the stable method; because, if well littered, the horses will not require any other dressing than is usually given by farmers' servants. Since, however, these animals are very susceptible of cold, it would perhaps be most advisable to keep them in stables, in all exposed and bleak situations; but, in mild and sheltered places, the shed-system will be found the most profitable. By the Earl of Darlington, who followed the practice for several years, it was found to answer very successfully; and his lordship remarked, that horses thus managed are not only more healthy than those kept in stables, but are also enabled to work well even after they have attained the age of twenty years.

The expense of keeping horse-teams cannot be estimated, with any degree of precision, on account of the fluctuating prices of oats, &c. as well as from the different methods of keeping. Reckoning, however, the consumption of oats, in well-fed horses, to be about ten quarters, and of hay about thirty-five hundred weight, together with 16s. or 20s. for shoeing, the charge may perhaps be computed at about 32*l.* or 34*l.* per annum.

As the diseases to which this useful animal is liable are various, and would require more room for discussion than the nature of this work can allow, we shall only observe, that in all cases where disorders appear in a team, recourse should be speedily had to an experienced farrier; as many valuable cattle have fallen victims to the nostrums imposed on the unwary by ignorant and designing persons.

III. ON BRITISH WOOL:

INCLUDING HINTS FOR THE IMPROVEMENT OF ITS
QUALITY AND QUANTITY.

THE importance of the woollen manufacture, both to the commercial and labouring classes of this nation, have long been felt; yet it is only within the last fifteen or twenty years that the subject has been scientifically considered, or any efficient measures have been taken in order to improve the quantity and quality of British wool.

As the protracted extent of the present work will not admit of a detailed account of prejudices which are now daily disappearing, we propose, in the present article, to state the essential properties of wool, and concisely to notice the improvements already made, together with those means which experience and reason evince to be the best calculated for that purpose.

The growth of wool is always completed in one year, at the expiration of which it spontaneously decays, and is naturally renewed. In this respect, indeed, the covering of sheep bears a close resemblance to the hair of most of the lower animals; though it differs widely in the following particulars: the wool is considerably finer, grows more uniformly, each filament growing at equal distances, and separating nearly at the same time from the skin; and, if not shorn in time, naturally falling off, being succeeded annually by a short coat of young wool. Another peculiarity in wool is, the different degree of thickness which prevails in various parts of the same sheep, being closer at the extremities or points than at the roots, and the part that grows during the winter being of a much finer quality than that produced in the summer.

Various are the names given to wool, according to its state or relative degree of fineness. When first shorn, it is termed a *fleece*; and every fleece is usually divided into three kinds, viz. the *prime*, or *mother-wool*, which is separated from the neck and back; the *seconds*, or that obtained from the tails and legs; and the *thirds*, which is taken from the breast and beneath the belly. This general classification of wool cor-

responds with the Spanish method of sorting into *Rafinos*, or prime; *Finos*, or second best; and *Terceras*, or inferior sort: but the intelligent wool-staplers in the eastern part of this island, distinguish not less than *nine* different sorts that are broken out of small fleeces, the names given to which prove the nice discernment of the persons employed. We have therefore subjoined them for the information of our less-informed readers.*

"No. 1. Is *Short-coarse*, and very descriptive of its character.

"2. *Livery*, } old sorts, into which the fleece was formerly

"3. *Abb*, } divided.

"4. *Second*.—Probably a second or better *abb*, and the first alteration in the mode of sorting; which arose either from the improvement of fleeces, or in the art of breaking them. This, and all the subsequent names, seem to have been in their regular succession at the top of the list.

"5. *Downrights*.—Perhaps intended to convey the idea of superlative perfection.

"6. *Head*, or *chief*.

"7. *Super-head*.—An advance upon the preceding sort.

"8. *Picked Lock*.—First made, perhaps, in small quantities.

"9. *Choice Lock*.—Still more excellent."

Beside these sorts there is another recently introduced into the list, and called *Prime Lock*; which, as its name indicates, is the finest possible that can be obtained.

Till within a few years, the finest wool manufactured in this country was obtained exclusively from Spain: next to Spanish wool, the English sheep indisputably furnish the finest commodity of the kind in Europe. Previously to the introduction of Spanish sheep, the finest and most esteemed sorts of British wool were the Ryeland, South-down, Shetland, Cotswold, and Cheviot fleeces: but by the judicious crossing of Merino rams with the choice British sheep, particularly of the Ryeland breed, wool of the *fourth descent* has been obtained, which, in point of fineness and texture, has proved *equal to the best Spanish wool*. For these interesting facts, the British nation is

* For these interesting distinctions we are indebted to Mr. Luccock's valuable Treatise on "The Nature and Properties of Wool," 12mo. 1805, p. 142.

indebted to the patriotic exertions of Lord Somerville, (who about 14 years since imported from Spain a number of genuine Merino rams at a vast expense), of the British Wool Society, the Board of Agriculture, and Dr. Parry of Bath.* And with the same noble views, his Majesty, for many years previous to his illness, annually permitted some of his Spanish sheep to be sold at reasonable prices, under the auspices of Sir Joseph Banks: but we understand that the whole of his Majesty's flocks have recently been disposed of.

We shall now proceed to state some of the principal requisites, which are indispensably necessary to constitute good wool. These are,

1. The *length of the staple*; for this regulates the various fabrics to which the fleece is destined. Thus, in carding wool, a *short pile*, and a disposition to assume a crumpled, or spring-like shape, is an object of prime importance. This shrivelling quality, Mr. Luccock remarks,† cannot prevail in too high a degree, if it be to make cloths requiring a close and smooth surface: but for cloths where a long and even nap is required, too large a proportion of this curling property he conceives would be detrimental: and consequently a *long pile* or *staple* will be preferable. Hence, it will be obvious to every attentive cultivator, that wool must be grown for particular purposes, according to the nature of the manufactures carried on in his vicinity. There is, however, a certain point, beyond which, if the crumpling quality proceeds, the wool becomes less valuable, on account of the superior length of the curves, which render it difficult to break the staple suffi-

* The details of the various experiments, conducted by the different public-spirited individuals above named, being too numerous for insertion, a few only of their general results can be given. Such of our readers as possess ability, leisure, and inclination to observe the gradual progress that has been made in this national object, will be amply compensated by a perusal of Lord Somerville's "System, followed by the Board of Agriculture," &c. 8vo. 1800; also his lordship's "Facts and Observations on Sheep," &c. 8vo. 1803; the second volume of "Communications to the Board of Agriculture," and Dr. Parry's "Facts and Observations on the practicability of producing British Clothing Wool equal to that of Spain;" and the ninth volume of the "Letters and Papers of the Bath and West of England Society."

† In his valuable Treatise on "The Nature and Properties of Wool," p. 147.

ciently. The distribution of the hairs in this staple has been compared to that of the grain in a very crooked piece of timber, or to waved bars of metal, so formed that the convex part of one fits into the concavity of another. As this peculiar property cannot be communicated to wool where it does not naturally exist, breeders of sheep will find it essential to their own interests to unite the valuable properties of wool with those of the carcass.

2. Pliability of wool is another important quality to which the attention of the grower should be directed; as, without this elasticity, it will be unfit for the purposes of manufacture.

3. The peculiar quality, by Mr. Luccock, termed the *felting quality*,* is of equal importance with the preceding, and, though not evident to the eye, is in fact indispensably requisite in all wools which are wrought up into such cloths as are submitted to the action of the fulling-mill. Mr. L. describes it as "a tendency in the pile, when submitted to a moderate heat, combined with moisture, to cohere together, and form a compact and pliable substance." This valuable property is possessed in a high degree by the Spanish sheep; and, according to Mr. L's opinion, the Cheviot, Morf, and Norfolk fleeces are best adapted for the purposes of fulling.

4. A soft pile is also an essential requisite to constitute a good fleece. In this, as well as in the other properties already enumerated, the Spanish wool peculiarly excels: and among the British fleeces, those of Shetland stand unrivalled in this respect.

5. The specific gravity, or relative weight of the pile is a quality to which the attention of wool-growers has not yet been directed so particularly as the subject requires. In order to ascertain the comparative weight of different samples, Mr. Luccock directs each of them to be brought as nearly as possible to the same degree of purity, to expel all the moisture which wool obstinately retains, and extract all the air contained in the interstices of the staple.†

6. The smell of wool is not a property to which much weight can attach: provided no disagreeable odours are emitted, or any of the effects of moisture are exhibited, Mr. L. considers no one scent to be preferable to another. It is,

* Treatise on Wool, p. 161.

† Ibid, p. 173.

however, essential that wool should, as far possible, be perfectly *white*.

7. The last property to which the attention of the cultivators of wool should be directed, is trueness of hair, or a uniform regularity of pile, in which no coarse, shaggy hairs are perceptible; as the latter, by reason of their brittle nature, will very materially affect the progress of the manufacturer. Such coarse hairs, as well as kemps or stichel hairs, (which are generally short, brittle, pointed, opaque, and of a grey or brownish cast), are found principally in neglected breeds. Since, however, the art of combining the properties of the parent sheep in their offspring has been generally known, the expert cultivator of wool has been enabled to produce surprising alterations in the relative weight and fineness of wool.

Various modes of classifying wool-bearing animals have been proposed, according to the particular purposes for which they are reared. The most natural division is, into *long-horned*, *short-horned*, and *sheep without horns*: and this division we have already adopted in the preceding part of this work.* But for *purposes of manufacture*, the quality of wool is obviously the best criterion; and this arrangement is adhered to by a very eminent grazier and wool-grower, the late Mr. Geo. Culley; to whose valuable observations on live stock we are indebted for the annexed synoptical table of the different native breeds of sheep.

* See pp. 8—15, *supra*.

A SYNOPSIS OF THE DIFFERENT BREEDS OF SHEEP IN GREAT BRITAIN.

	no horns		white faces and legs		long wool	Average weight of fleece per lb.	Price of Wool, per lb.	Average weight of wethers, per quarter.	Years old when killed.
							s. d.	lbs.	
1 Dishley						8	0 10	25	2
2 Lincolnshire						11	0 10	25	3
3 Tees Water						9	0 10	30	2
4 Dartmoor Natts						9	0 8	30	2
5 Exmoor					ditto	6	0 8	16	2
6 Dorsetshire					fine short wool	3½	1 2	18	3
7 Herefordshire					very fine short wool	2	2 9	14	4
8 South-down					ditto	2½	2 0	18	2
9 Norfolk					grey faces and legs	2	2 5	18	3
10 Heath					black faces and legs	2	0 6	15	4
11 Herdwick					fine short wool	3½	0 6	10	4
12 Cheviot					coarse long wool	2	0 6	10	4
13 Dunfaced					speckled faces and legs	3	0 11	16	4
14 Shetland					white faces and legs	1½	3 0	7	4
					fine short wool	1½	3 0	8	4
					colours various				
					fine cottony wool				

A more accurate knowledge, however, may be obtained of the nature of the wool cultivated in different counties, from the following table, in which Mr. Luccock has arranged the *quality of English Wool, according to the fineness of its pile.*

CLASS—No. I. Packs.		No. II.	Packs.
York, West-Riding	6678	Cambridge,	1128
— East Do.	6380	Hunts,	2000
— North Do.	5939	Beds,	4520
Westmoreland,	3262	Kent,	7000
Cumberland,	5915	Hants,	7257
Lincoln,	2833	Devon,	7280
	—	Cornwall,	3382
	31007	Berkshire,	4151
	—	Oxford,	5303
No. III.		Bucks,	2787
Essex,	6486	Herts,	5297
Surrey,	3540	Middlesex,	750
Wilts,	8144	Stafford,	1526
Dorset,	9880	Warwick,	2287
Somerset,	9388	Leicester,	291
Gloucester,	5400	Nottingham,	4112
Monmouth,	1431	Derby,	4530
Worcester,	4820	Chester,	926
Shropshire,	4397	Lancaster,	4522
	—	Durham,	3320
	53486	Northumberland,	12333
	—	North Wales,	5692
No. IV.		South Do.	3570
Norfolk,	5697		—
Suffolk,	5176		93694
Sussex,	9477		—
Hereford,	4200		—
	—		
	24550		
	—		

THE AVERAGE QUALITY

Of short wool is, 1 inch divided by	871, value 15 <i>l</i> .
Of short fleeces,	885,
Of long wool,	600, value 13 <i>l</i> .

TOTAL VALUE OF ENGLISH WOOL.

245,290 Packs of short wool, at 15 <i>l</i> .	£.3,679,350
137,228 Do. long Do. 13 <i>l</i> .	1,783,964
10,718 Do. lambs Do. 10 <i>l</i> .	107,180
393,236 Packs.	Total £.5,570,484

The Slaughter of short-woolled sheep is	£.4,221,748 per ann.
Carriage of Do.	211,087
Slaughter of long-woolled sheep,	1,180,413
Carriage of Do.	59,020
Slaughter of lambs,	1,400,560
Carriage of Do.	70,028
£.7,142,856	

The number of lambs yeanned per ann. is	£.7,002,802
Annual decrease,	140,054
£.7,142,856	

In describing the fleeces of this country, Mr. Luccock* disposes them in two classes, which are mutually distinguished by the length of the staple and the mode of manufacturing them; the one being suited to the fabrication of worsteds, and the other to the making of woollen goods. The sheep from which these different kinds of staple are obtained, do not always run promiscuously in the same flock, or graze upon the same pastures; each being most commonly found upon its

* Treatise on Wool, p. 133.

appropriated soil, and under a peculiar management. Sometimes the line which separates them is boldly drawn; at others the pastures are so mingled, or the qualities of the land so gradually change from those which are suitable to the heavier sheep, as to give the stock a sort of mongrel appearance, and the fleece an uncertain character. But human genius, always fertile in expedients, has rendered even this defect of the fleece advantageous to the interests of society; and has adapted to it the manufacture of stockings.

Thus although long wool is found in many detached parts of England, it is much more common on the eastern than on the western side, and often nearer to the coast than the middle of the kingdom. Sometimes it is produced upon a few acres which are surrounded by land of a different description, and grazed by sheep of another character; these tracts, being too small to deserve general attention, will be passed unnoticed, and the wool included in the common produce of the district where it grows. Among the larger ranges of long-woolled sheep, the first to be noticed, and the most northern, is situated near to the mouth of the Tees, a river separating the bishopric of Durham from the county of York. The second, which may properly be denominated the Lincoln district, comprehends the south-eastern point of Yorkshire, nearly the whole of Lincolnshire, and the fen lands of Huntingdon, Cambridge, and Norfolk. This kind of wool is found in the smaller marshes of Essex and of Kent which surround the inlets of the sea, but is much more abundant in those of Romney and of Guilford. We meet with it in the counties of Dorset, Devon, and Cornwall, upon the Cotswold-hills, in some detached parts of Lancashire, Oxford, Bedford, and Stafford, through the whole of Leicester, Rutland, Northampton, and Huntingdon, and along the banks of the larger rivers.

But it is remarked by Mr. Luccock, that the short wools of the kingdom do not arrange themselves so distinctly in districts as those of a longer staple do, but fill up the whole space besides that which has been noticed as the pasture of the heavier breeds of sheep. Those families which produce a fleece suitable to the card, though originally possessing features much more strongly characteristic than are found in the other kind, are sometimes so mingled with each other, and with the sheep of the larger fleece, as to render it difficult to determine

what particular race many of the individuals belong to. Yet it will be found most convenient to describe them in classes, and to proceed from that county where the species appears most pure, to those where its blood becomes intimately mingled with that of another variety. We know not the period when any of these sheep were introduced into the country, nor whence they were procured, but there remain at present in England and Wales, six different kinds of them, viz. the Norfolk, the South-Down, the Wiltshire, the Ryeland, the Heath sheep, and the Mountaineer; besides some small collections of different varieties, which seem to have descended from families now almost extinct.*

Only two modes, says Mr. Luccock, have yet been adopted for the improvement of fleeces. "One consists in selecting those lambs for slaughter which have the least valuable coat; the other, in bringing into the flock male sheep of the most approved breeds, in order that their progeny may perpetuate their best peculiarities."† It is in fact by the judicious crossing of different breeds with Spanish sheep, that so much has been done towards the amelioration of British wool: and, since this subject has been very ably treated by a neighbouring practical writer,‡ we have selected the following important principles, founded on actual experience, for the consideration of all judicious wool growers.

1. Every person, who is desirous of having a fine-woolled flock, must select the finest rams that can possibly be obtained, particularly at the commencement of his undertaking, i. e. for the first generation: for, if the ram for the second race is finer than that employed for the first, it is evident that time has been lost in effecting the proposed improvement.

2. In like manner, the finer woolled the ewe is with which the improvement commences, so much the more rapidly will that of the breed arrive at the degree of superfine.

3. The greatest attention is requisite that the rams employed for the subsequent breeds be as fine as the first; otherwise the amelioration will be retarded.

4. Where a breeder is desirous of stopping at a certain degree of fineness, without proceeding any further, he may

* Treatise on Wool, p. 137.

† Ibid. p. 350.

‡ Mr. Fink's Treatise on the "Rearing of Sheep in Germany, and the Improvement of coarse Wool," published (in German) at Halle, 1799.

easily effect this object. It will in such case be sufficient to take a ram and ewe of the first or second race; he will have one half or three-fourths fine; and his flock will retain this degree of fineness without any additional improvement.

5. Unless the breeder be minutely attentive to the selection of his rams, the produce of his embraces will have only one-fourth part of the Spanish fineness.

6. If an unimproved ewe be put to a ram of a mixed breed, and which has only one-fourth part Spanish in him, the offspring will only have one-eighth Spanish: by continuing to propagate in this manner, a complete separation of the two breeds will at length be effected.

But Mr. Luccock is of opinion, that flocks might be amended much more rapidly, if, in addition to the common methods above detailed, a kind of barter in lambs were adopted between two neighbouring districts, one of them possessing a superior, and the other an inferior breed of sheep. If these could be exchanged in such a manner that the inferior sorts only should be sent to the markets, while the good ones were preserved, he affirms that the British flocks would annually become more valuable; as a few seasons would be fully sufficient to dispossess the least cultivated breeds of their present pastures. Our limits do not allow us to notice the objections which he conjectures may be made to this proposal; but, as it is evidently the result of much reflection and experience, we leave it to the consideration of the attentive reader.

Mr. Bakewell, however, has brought forward some facts and observations, which render it probable that the fineness of wool depends upon the *difference of soil*.* Having, early on his introduction into the wool business, noticed a remarkable difference in the softness of wools equally fine, but which were produced in different districts, Mr. B. was led to believe "that the herbage of each district derived from the difference of soil some peculiar properties, which gave to it, as the food of sheep, the power of affecting that process of the animal economy by which wool is produced.

"The soils more favourable to this soft quality were, first, the argillaceous; next, the siliceous; and it was well known, that calcareous soils, whether limestone or chalk, produce

* "*Observations on the Influence of Soil and Climate upon Wool*," &c. 8vo. 1808.—The value of this work is considerably augmented by several important notes communicated to the author by the Rt. Hon. Lord Somerville.

wools of a contrary quality, remarkable for their harshness to the touch. In proportion as the above earths preponderate in a loose state near the surface of different soils, their effects may be detected, whatever be the breed of sheep from which the wool be shorn.*

These remarks on the effects of chalk upon wool, are limited to chalk alone, by Lord Somervillve, who considers them as inapplicable to limestone soils in general. "Lime," his lordship observes, "certainly may be burnt from chalk as well as from the limestone: as chalk, it is conveyed into the fleece by contact in its natural state; but limestone, if it does not lie deep below the surface, as is usually the case, is a hard and clean stone, and can communicate nothing to the wool until it is rendered into lime by the strongest effect of fire. This doctrine militates also against the whole of our practice in the western counties. The pile of all my Merino wool, even of the pure blood, is publicly admitted to be improved; it has been constantly grown on a limestone soil, and the surface of the land manured with lime in each course of cropping, and to the extent of 100 bushels per acre of the best popple-lime, the quality of which has been ascertained by Mr. Davy, to whom specimens were sent; it has been treated on in his public lectures, and its quality ranks among the strongest of our manuring lime. As the author speaks so positively on the effect of limestone on wools, we may conclude that the limestone of Derbyshire and the adjoining counties does produce this effect."

Mr. Bakewell conceives that the *soft quality* of wool may be preserved in every situation by *greasing the sheep*; and that the same means will also contribute to counteract the effects of climate and soil, where these are unfavourable to this quality; and further, that sheep will thereby be preserved from cutaneous distempers, from the change of climate, and from the sudden change of temperature after shearing. Mr. B. strenuously advocates the practice of greasing sheep, proving its antiquity as well as its usefulness by details of facts, for which we reluctantly refer to his work, as this article would otherwise be extended beyond our confined limits. The result of his practice, however, may be comprised in the following positions, distinct from the recital of facts by which they are supported. Mr. B. infers,

* Bakewell on Wool, p. 5.

1st. That hair differs from wool, by the greater degree of hardness and elasticity of its fibres.

2d. That some wools resemble hair in this quality more than other wools which are much coarser.

3d. That the hard quality found in some wool, prevents it from making cloth of the same value as the softer wools, if the former are considerably finer than the latter.

4th. That the application of unctuous matter sufficiently soft and tenacious to cover and remain upon the fleece, will defend it from the action of the soil, and is found to produce the soft quality of wool, so desirable to the manufacturer.

Hence the greased wools of Northumberland and Yorkshire possess a superior degree of softness to any ungreased wools in the kingdom.

Hence sheep that have received the benefit of this practice, and are driven into other counties not remarkable for soft wools, still preserve the distinguishing softness of their fleece. Hence we learn the reason why ointments, when casually employed to cure some disease of the animal, have also generally been found beneficial to the wool.

If these facts and inferences be admitted, we may also infer, that an improved method of greasing fine-woolled sheep should be adopted in every part of the kingdom, and that it would greatly improve the quality of the wool, and annually save many thousand sheep from perishing by the severity of the weather.*

The same experienced writer recommends the washing of sheep in tubs with warm water, previously to shearing, agreeably to the Swedish practice; which Mr. Bakewell recommends, in order to remove all objections against *greased wools*.

"It would," says Mr. B., "be desirable that the Spanish and mixed breeds of sheep were also washed in this way, because it is not possible to cleanse the fleece by the usual practice of immersion in a river, without keeping the animal a long time in the water, and thereby endangering its health. Indeed I do not think the Spanish fleeces can be cleansed by the usual mode of washing, on account of the closeness of the pile. Were the Spanish sheep in this country washed before shearing as clean as

* Bakewell on Wool, p. 63.

the English, the value of their wool would be better ascertained by the wool-buyer, and a more general competition of purchasers would always insure a fair price for the article.

"The extra labour required to wash sheep in tubs with warm water and lie, or soda, would, I apprehend, be amply repaid, were the water of the first and second washings carried out and applied as a manure. The quantity of rich animal soap it would contain must make it one of the most fertilizing applications which could possibly be used. The greased wool would require a greater quantity of soda to cleanse it than that of the Spanish or mixed breeds, where no ointment had been applied. I annex Baron Schultz's account of the Swedish manner of washing sheep: I think some improvements upon it will suggest themselves to the intelligent wool-grower.

"Before the shearing, the wool with us is almost universally washed upon the sheep. Some persons wash the sheep in the open sea, or in running water, but this is never so clean as when the sheep are first washed in a large tub, with one part clear lie, two parts lukewarm water, with a small quantity of urine; and then in another tub, with less lie in the water; after which the sheep are washed, laying them always on their backs, with their heads up, in a tub with clean water; and lastly, there is poured out on the sheep, standing on the ground, a sufficient quantity of water, which is as much as possible squeezed out of the wool. The sheep are afterwards driven into an unpastured adjoining meadow, and remain there (to prevent their soiling themselves in the sheep-house) a day and night, not only till they be dry, which in good dry weather happens within the third day, but also, if bad weather does not threaten, some days longer. Some persons wash their sheep twice, which I also once tried, but the wool becomes rougher in consequence of it, and in fact of a greyer appearance. The great quantity of grease which the finest Spanish wool contains at the first washing, mixes with the lie-water, and makes it quite soft and soapy; but this grease is wanting in the second washing, so that the water is not in the least softened. If the first washing be well performed, the wool is by that means several per cent. cleaner than the foreign wool that is imported, which has not been washed after the shearing."*

* Bakewell on Wool, p. 72.

The inconveniences attendant on the common mode of marking sheep, having already been adverted to in the course of this work, we shall conclude this article by briefly noticing a new method of marking sheep, suggested by M. Lasteyrie. Horses and other cattle, it is well known, are usually marked on the thigh with a red-hot iron; but, this is not practicable on sheep, unless perhaps the iron be applied to the forehead, jaws, or horns of the animal; and even in this case only one common mark can be given to a certain number of sheep. It is, however, essential, that a distinctive mark be given to each animal: with this intention M. Lasteyrie states, that some breeders on the Continent avail themselves of metallic plates whereon the numbers are engraven, and which they fasten with a piece of pack-thread to the neck, or with a piece of wire to the ears of the animal. But as this method can only be adopted under certain circumstances, and is further liable to many inconveniences, M. Lasteyrie proposes to *make notches* in the ears of sheep, as the most easy and certain expedient.

Where, indeed, a pure, as well as a mixed breed of sheep is reared on the same farm, it will become necessary, in order to avoid mistakes, to distinguish those of the first breed with a different mark from that employed for the sheep of the second breed. In this case, he proposes to apply to the face of the animals an iron, previously made red, and which should be from three to five lines in diameter. Each individual of the flock must next be marked with a number formed by cutting notches in the ears. Two Roman cyphers (viz. I and V) will be sufficient to form a series of numbers from 1 to 199; beyond which number a new series must be commenced, by marking the animals of the second, third, fourth, or other series, with iron tinged with red, and bearing a different impression from that already employed, or by placing such iron on different parts of the face. Thus the most numerous flocks may be numbered with facility.

The marks are formed by cutting the two Roman cyphers on the upper or lower extremity of the ears; though the last is preferable, as the former better protects those organs from the rain, and other severities of the weather. The right ear will have the units, and the left ear the tens, Number I. to IIII. inclusive will designate as many units: a small portion of the

ear must then be taken off in this form, V, to mark No. 5; and the subsequent number, to nine inclusive, may be indicated in the following manner:

No. 6, by	VI.
7, ...	VII.
8, ...	IV.
9, ...	IIV.

The marks, which on the right ear denote *units*, will on the left ear signify a corresponding number of *tens*.

M. Lasteyrie* has also proposed another system of numbering sheep; by means of which it would be easy to ascertain by one glance the genealogy of the individuals. Where a farmer then has a flock, from which he is desirous of raising a breed, the animals may be numbered in the manner already indicated; and each new lamb may be marked on one ear with the number of its mother, and on the other with that of its sire. The upper edge or extremity of the ear, would, in this case, serve to designate the units, and the lower the tens. It would further be easy so ascend to the whole series of generations from son to father, by examining the age of each individual from the teeth. This method, M. Lasteyrie thinks, has its advantages, especially where no register is kept of the flock.

The breeder would, however, find it conducive to his interest to keep a register, in which the numbers of each sheep might be marked: here also should be entered such observations (which ought to be carefully made) as not only related to the coupling and crossing of the breeds, but also those experiments he may wish to try upon the animals. A careful cultivator, who is solicitous to improve his art, will, in such register, notice the defects, or other qualities of his sheep, their respective states of health or disease, the nature of their wool, the profit they yield, &c. Thus it will be easy to ascertain what individuals it will be proper to dispose of every year, as well as those from which it will be advantageous to breed: and, at length, the object proposed will be obtained, viz. the improvement of the breeds, and deriving from them the greatest possible profit.

* Histoire de l'Introduction des Moutons à Laine fine d'Espagne, &c. p. 254.

IV. ASSES—MULES.

THESE useful animals, when domesticated, are remarkable for their meekness, patience, tranquillity, and (though too often treated with cruel harshness) attachment to their masters. No beasts, perhaps, are capable of supporting heavier burthens, in proportion to their size, than asses; on which account they are principally employed in drawing hucksters carts. But it appears from actual experiment, that these useful animals may be employed, to great advantage, in drawing waggons, and other carriages. Thus the Earl of Egremont, (*"Annals of Agriculture,"* Vol. 37,) early in 1800, formed a team, consisting of six male asses, and, during nine months, he found them of great service. They brought one chaldron and a quarter of coals twice a day, in a waggon, from the canal to his lordship's house at Petworth, which shows a degree of strength not to be expected of them. They were gentle and docile; during winter they had no oats, nor any other hay than the bands of the trusses consumed by horses, but lived on furze and holly.

A more striking instance of the utility of asses for the purpose of draught has been communicated to the public by Mr. Worthington, who made use of the implements in common use, except as to size, accommodating the height of his wheels, &c. to the line of draught, enabling his asses to draw without any inconvenience; and employed them in various departments of agricultural labour. His practice is to work four asses at plough, yoked two a-breast, driven in hand with reins by the ploughman: and he found that they were more than masters of the work required from two common farmer's horses of a slight kind. Mr. W. esteemed an acre a good day's work; but in cross-ploughing they would do more; at such work two asses were sometimes enough, and two were also sufficient in turning the furrow at potato-planting. The soil on which these animals were employed, was a loamy stone brash, of middling but varying depth, and tenacious rather than light.

The ass appears to be exempt, not only from the contagious disorders so fatal to other cattle, but also from all ailments whatever.

"In respect of consumption," concludes Mr. Worthington, "I can only add, that the ass is a temperate eater; and that he appears to thrive best, when left at large to his bramble-leaves (which flourish almost through the whole winter), with a little corn at his breakfast and at the close of work, and a bite of hay at noon in his geers; and he may also be safely trusted abroad with his associates, as, unless in his rutting season, he scarcely ever strays. He loves grains, and will eat them freely; and is foud, beyond any other food, of the culinary roots, in particular of potatoes and carrots."

As, therefore, the preceding statements fully prove the hardy nature of asses, and as these useful animals may be kept at a trifling expense, they certainly deserve the consideration of every intelligent farmer and breeder: and we fully concur in the opinion of Mr. A. Young, that "they will be found by far the cheapest team that can be used."

MULES

are a mongrel kind of animal, partaking of the nature both of a horse and of an ass. They are very hardy, strong, sure-footed, and durable, and live to a great age; on which account they are much used in warm climates. These animals are also employed to some extent in Ireland, and in some of the northern counties of Britain: those which are bred in cold countries, are reckoned to be more stout and fit for labour than such as are bred in warmer climates.

In the breeding of mules, it will be requisite to select the finest male asses, and young, lively, well-formed mares. If he-asses, fit for the purpose, cannot be procured, it has been recommended to get a strong male, and two female asses; and to take special care of their colts, which will, in the course of three or four years, be fit for the purpose. Young mule colts will require to be housed during the first winter, so that they may be frequently handled, in order to make them tractable. At three years of age they may be broken in, and should be moderately worked until four; after which, with proper management, they will continue in full vigour and work, even forty years. But no wheat or rye straw should be given, *in any form*, as it will disagree with them, and render them unfit for labour.

V. POULTRY—RABBITS.

UNDER the term *Poultry* is comprised every species of land and water fowl, and also pigeons: on each of these we shall offer a few remarks.

I. LAND FOWL.

1. Of *Common Fowls* there are several breeds, known by the names of the Bantam or Game breed—the Poland or Black breed—the Dorking—English or White—and the Shack-bag and Malay breeds. When well fed, and permitted to range in a farm-yard, a good hen will lay from 150 to 200 eggs, and upwards, in the course of a year. She prepares her nest with art and care, either among bushes, or by scratching a hole in the ground: the time of hatching is preceded by a clucking noise, and the hen ceasing to lay eggs. A good hen can rear a brood of ten or twelve chickens at a time: The proportion of hens is usually six or seven to one cock.

Poultry constitute part of every farmer's stock; but it is not in every county they can be profitably reared: but if proper conveniences be provided, and with careful management, this otherwise fluctuating part of live-stock may be turned to good account.

In order to fatten poultry to advantage, they should be kept in a detached airy place, either with separate apartments for each species, or (if sufficient room be allowed to each kind), together. In an interesting communication to the Board of Agriculture, we are informed, that Mr. Wakefield (a spirited farmer in the vicinity of Liverpool) keeps a large stock of poultry in the same place, with similar success. Mr. W. has a plot of land, about three fourths, or nearly an acre in extent, inclosed with a fence of six or seven feet in height, composed of slabs set on one end, or any thinnings of fir or other trees split, and put closely together. They are fastened by a nail near the top, and by another near the bottom, and are sharp-pointed, which (though the fence is so low) is supposed to prevent the fowl from flying over, as they never attempt to

escape. Within this fence, are places slightly put up, *but well secured from wet*, for each kind of poultry; and a pond, or current of water, runs constantly through it. Here they are regularly fed three or four times a day with steamed potatoes, with the happiest success, as the fowls thrive perfectly well. What renders this system of poultry-management more worthy of attention, is the great quantity of dung made in this place, and, when it is cleared out, a thin paring of the surface is taken off at the same time, which affords a valuable compost.

As one great objection to the rearing of poultry, on small farms, arises from the quantity of grain, &c. needlessly consumed, we conclude this part of the present work with the following interesting method of rearing fowl, as practised by Mrs. Boys, of Betsanger, in Kent:—"The labourers' wives and families," says Mr. Young,* "who live on Mr. B.'s farm, do the whole: he supplies them with what offal corn is necessary, and they return Mrs. Boys the grown fowls ready for market, at three-pence each; sixpence for turkies and geese, and three-pence for ducks: and her account, well kept, states a profit of twenty pounds a year, after all expenses are paid, and the family well supplied; they have also all the eggs without any payment. It answers as well to the people as it does to the farmer."

The following *easy* and *economical* method of rearing poultry has been communicated to the *London Society for the Encouragement of Arts*, &c. by Mrs. D'Oyley, of Sion-hill, near Northallerton, who received the Society's silver medal for the same. Where poultry are reared expressly for the market, this method is certainly deserving of attention.

Mrs. D'Oyley keeps a large stock of poultry, which are regularly fed every morning upon steamed potatoes, chopped small, and at noon upon barley. In the poultry-yard is a small building, like a pigeon-house, in which the hens lay, with a frame with nets to slide in before each hole: the building is kept dry, light, and well ventilated; and once a week the floor is strewn with fresh ashes. When she wishes to procure chickens, she sets many hens together, confining each to her respective nest, by drawing the sliding net, before the hole; and they are daily let out for air, exercise, and food.

* Farmer's Calendar, p. 55.

As soon as the chickens are hatched they are taken away, and the hens have a second lot of eggs allowed them to sit again, by which means they produce as numerous a brood as before. Mrs. D. puts the chickens into long wicker cages, placed against a hot wall at the back of the kitchen fire, and within them has *artificial mothers*, under which the chickens run. These mothers are made of boards, about ten inches wide and fifteen inches long, supported by two legs in the front, four inches in height, and by a board at the back two inches high. The roof and back are lined with lamb-skins, *dressed with the wool upon them*, and the roof is thickly perforated with holes: they have no bottom, but have a flannel curtain in front and at the ends for the chickens to run under; which they apparently do by instinct. The cage is kept dry and clean, either with sand or with moss, and is of a proper size for fifty or sixty newly hatched chickens.

When a week old, they are carried together with their artificial mother to a grass-plot in fine weather; and the mother is kept warm by placing a long narrow tin vessel at the back, filled with hot water, which will retain its heat for three or four hours at a time; and, towards evening, they are removed back again to the hot wall. When *three weeks* old, they are put into a small room appropriated to that purpose, which is fitted up with frames similar to the artificial mother, placed round the floor, and with perches conveniently arranged for them to roost upon.

When Mrs. D'Oyley first attempted to rear poultry in this way she lost several, owing to the roof of the mother not being sufficiently ventilated; and experienced many losses from improper food, until she thought of getting coarse barley-meal, and steaming it until it became soft; with which, and with minced potatoes, they are fed alternately, and are frequently excited to eat by pellets of dough that are thrown to them.

Upon this food the young chickens are stated to grow surprisingly, and soon become fit for the table or market: and Mrs. D. conceives that her method might be pursued near populous towns with immense profit. A young person, it is stated, of twelve or fourteen years old, might bring up some thousands in a season; for hens may be set four times in the year, and be made to rear two broods at each setting. The proper heat of the wall is 80 degrees of Fahrenheit's thermo-

meter; and the troughs for the food are placed without side the cages, from which to the artificial mother, a small quantity should be littered, in order to point to the trough.*

2. *Turkies* subsist on grain and insects: the female lays from ten to twelve or fourteen eggs: contrary to all other species of poultry, these birds do not require the constant attendance of the male during the laying season, on which account Mr. Marshall ("Rural Economy of Norfolk,") informs us, that it is the practice in that county to send the females to some neighbouring cock to be impregnated, one act being found sufficient for a breed. Young turkies are extremely tender, and require the utmost care and attention, being much oppressed by cold: hence, in Sweden, it is the practice to plunge young turkey-chicks into cold water soon after, or at least in the course of the day they are hatched; after which they are forced to swallow a whole pepper-corn, and they are returned to the hen. The *black* breed is preferable to the white or speckled kinds, being superior in point of size, and also more hardy.

Turkies are very apt to straggle, and often lay their eggs in secret places. They should therefore be carefully watched and made to lay at home: they begin to lay in March, and will sit in April. They rarely sit on more than from eleven to thirteen eggs, which are hatched in twenty-five or thirty days. The young brood must be kept very warm, and they may be fed either with curds or fresh cheese, chopped in small pieces, with onions or leeks; and their drink may either be new milk; or milk and water. Some persons give them a thick porridge of milk and oatmeal, into which are put onions or leeks chopped small, and sometimes eggs boiled hard and cut into small pieces.

Young turkies also will require to be fed *frequently*, as the hen will not take much care of them; and when they have got some strength, they should be fed abroad in a close walled place, whence they cannot stray. Care should be taken not to let them out until the dew is off the grass, and to have them home again before night, the dews being very prejudicial to them.

When young, this species of poultry may be very expeditiously fattened by means of boiled potatoes and barley-meal,

* Transactions of the Society of Arts, &c. Vol. xxv. p. 24—29.

well mixed together, with chopped onions, or leeks, *provided they be kept fed in a regular manner*. Nothing, in fact, can be more irrational or absurd than the practice of cramming turkies, which can only fatten in proportion to the quantity of food *DIGESTED*, whatever quantity may be forced upon them. Besides, it has been well observed, that they will eat their food *fast enough*, if regularly fed, however custom may have sanctioned such a method of fattening them.

The *Norfolk Turkeys* have long been celebrated for their *fine flavour*: this is to be attributed to the dryness of the soil in that district, and to the *extensive range* over which they are suffered to wander, while in their young growth, rather than to any peculiar excellence in the method of fattening these birds.

3. *Guinea Fowls* (which are natives of Africa), are not so tame and domestic as native poultry. They lay a large number of eggs, frequently from 100 to 150: they breed pretty well in this climate, but often occasion considerable trouble to their keepers, by flying away into hedges and bushes, especially during the night, where they lay and hatch their eggs. They are probably better for the table than the common fowl, being larger, and having more of what is called the *game flavour*.

4. *Pigeons* are uncommonly prolific; and, although pigeon-houses occur on many farms, yet if these birds be suffered to increase beyond a certain proportion, they will prove highly destructive to newly-sown crops (especially of young peas), and also in the early part of harvest, by sitting in large numbers upon the standing corn, and beating down the ears. All farmers ought to keep pigeons, to pick up the seeds of weeds in winter; for it is worthy of observation that, whenever a pigeon is shot at that season of the year, its crop will be found full of the seeds of weeds, from which it appears that they are very useful in clearing land.*

Where pigeons are kept, an airy situation, open to the south or south-west, is preferable; and common salt and nitre should frequently be given them, in order to keep them in health.

Dove-cotes, or pigeon-houses, ought to be built of a moderate height, and spacious, so that the birds may find sufficient room to fly about them with ease; and, in case any external object should alarm them, that they may readily escape. In

* Parkinson's "Experienced Farmer," Vol. ii. p. 406.

constructing the nests, it will be advisable to interweave wickers, in imitation of those formed by wild pigeons; as they will thus be more easily domesticated, and have no inducement to forsake their habitations.

Should any repairs become necessary in the cote, or in the nests, it will be proper to complete them before the middle of the day; because, if the pigeons be disturbed in the afternoon, they will not rest quietly during the night, and the greater part will perhaps sit *moping* on the ground till the ensuing day: such unfavourable accidents in the breeding season, will either occasion the destruction of many eggs in embryo; or, if there should be any nestlings, they will consequently be starved.

In Mr. Parkinson's *Experienced Farmer*, we meet with a remark made by a skilful pigeon-breeder, who cautioned him "against letting the first flight fly to increase his stock," but advised him to take them without exception; because they will otherwise appear at the *Benting-season*, that is, between seed-time and harvest, when pigeons are very scarce, and many of the young birds would pine to death, from mere weakness.—Pigeons rise early: and, as they require to be supplied with food only during the *benting-season*, it should not be carried to the cote later than three or four o'clock in the morning: for, if it be served long after that hour, they will hover restlessly about the house, and thus be prevented from taking their proper exercise. During the greater part of the year, they ought to provide their own food: as they will find abundance in the fields, from the commencement of harvest to the end of the sowing season: on the contrary, those which are constantly fed at home will not be prolific.

The spring-flight generally appears in the month of April or May; when all the eggs, which have been laid too late, must be removed. And, as the weather becomes cold after the harvest, the parent bird should not be suffered to sit so late as to be injured; for, though the young ones be hatched, they will be weakly and useless; a warm situation being most suitable to their nature.

The utmost cleanliness ought to prevail in pigeon-houses: hence the holes should be carefully examined before the breeding-season arrives. If any of the young die during the summer, they will speedily become putrid, and emit a disagreeable stench, which is extremely injurious to the inhabi-

tants of the dove-cote: thus, from the insupportable and filthy smell, they are often unwillingly compelled to quit the eggs laid for a second brood; so that the principal part of the season is lost. Further, as pigeons are very liable to be infected with fleas, all the nests ought to be cleaned; and, if it be conveniently practicable, they should be *washed out*, and the dung, or other impurities, removed, immediately after the first flight is hatched: this business, however, should, on all occasions, be performed at an early hour in the morning; and the remaining eggs must likewise be removed, so as to render the habitation perfectly clean for the harvest-flight.

Thus managed, pigeons will thrive and multiply to an uncommon degree; but, as they have a great antipathy to owls, which sometimes enter their habitations, such intruders must be immediately destroyed. Rats, cats, weasels, and squirrels, are likewise their *mortal* enemies, and will speedily depopulate a whole dove-cote. To prevent these depredations, it will be necessary to examine the different avenues to the pigeon-house, regularly once a week, or oftener, and with minute attention.

II. WATER FOWL.

I. Of *Geese*, there are two sorts, the Grey Lag, or Wild Goose, and the Tame Goose, or domesticated Grey Lag. The goose in general breeds only once in the course of a year; but, if well kept, it will frequently hatch twice within that period. Three of these birds are usually allotted to a gander; for, if that number were increased, the eggs would be rendered abortive: the quantity of eggs to each goose for sitting, is about twelve or thirteen.—While brooding, they ought to be fed with corn and water, which must be placed near them, so that they may eat at pleasure. The males should never be excluded from their company, because they are then instinctively anxious to watch over, and guard their own geese.

The nests, in which these birds sit, ought to be made of straw, and so confined that the eggs cannot roll out, as the geese turn them every day. When they are nearly hatched, it will be requisite to break slightly the shell near the beak of the young gosling, as well for the purpose of admitting air, as to enable it to make its way at the proper time.

Geese are very valuable, on account of the feathers they afford: for this purpose they are unmercifully plucked in the county of Lincoln, (where they are reared in the largest numbers) *five times* in the year: the first operation is performed at Lady-day for feathers and quills, and is repeated four times between that period and Michaelmas, for feathers only. The old birds submit quietly, but the young ones frequently prove unruly and noisy. The latter may be plucked once, when about thirteen or fourteen weeks old, for feathers; but no quills must be taken from them; nor should this operation be performed at too early a season, because the goslings are liable to perish in cold summers.—Although the plucking of geese has by many been considered as a barbarous custom, yet experience has evinced, that these birds, when properly stripped of their feathers, thrive better, and are more healthy, than if they were permitted to drop them by moulting.

In the fattening of geese the same attentions are requisite as in fattening other poultry. They should therefore be confined in a dark place, at a distance from the rest, and fed with oats or other grains; being well supplied with water and sand. Another mode of fattening geese consists in giving them boiled oats with chopped carrots or ducks'-meat, alternately: but, where green geese are to be fattened, it will be necessary to give them a little green food, with the grain used for that purpose. In two or three weeks they will be fit for the market.

2. *Ducks* frequent the lakes of various countries, in a wild state, where they feed on frogs and various kinds of insects: in a tame state, they may be profitably kept where there is a conveniency of water contiguous to the farm-yards, when they will require but little attendance. These birds lay at an early period of the year; and though they lay a larger number of eggs, no bird should be permitted to sit on more than ten or twelve eggs. These, in the course of a month, will be hatched; and the young ducks should be kept for another month at least, or until they be tolerably strong, with the old birds, and fed with grits, oat or barley meal, mixed with boiled potatoes, as wanted, sand and water being constantly kept in shallow pans. Ducks are greedy feeders, but by no means nice in the kinds of their food: they are peculiarly fond of the entrails of other animals; and when fattened on animal food (which very

expeditiously accomplishes the business,) they are said to have more resemblance to the wild-duck, both in the flavour and colour of their flesh, than in the common method.* Tame ducks are very useful for destroying the black caterpillars, slugs, and snails, that infest turnip fields, into which they may be very advantageously turned, as they will devour the vermin without injuring the crops.

III. RABBITS.

In a wild state the furs of Rabbits are of a brown colour; when domesticated, they are generally black, white or pied. The two kinds chiefly reared, are the common grey and the silver grey breeds, the former of which is chiefly valued for their flesh, as the latter are for their furs. The does begin to breed from six to twelve months, and are very prolific; they will bring forth seven or eight times in the year, but it will not be advisable to let them take the buck oftener than three or four times a year.

Rabbits are reared either in *warrens* or in *hutches*; in the former state they are permitted to roam at liberty, where they burrow and breed. The best places for such purpose are sandy hills, or those which consist of a loose soil; but it will be necessary to inclose them either with a stone or sod wall, and at the same time to bore horizontal cavities for the passage of these quadrupeds, till they have formed their own burrows:—the most proper shrub to be planted in such situations is the juniper-tree, the leaves of which are eagerly eaten by rabbits, and impart to their flesh a delicate spicy flavour. As warrens are infested with kites, pole-cats, eagles, and other free-booters, it will be advisable to set traps on the stumps or tops of old trees, or on artificial hillocks of a conical form, in order to catch these depredators, as they usually alight upon such places.

If rabbits are designed to be reared in a tame state, the *hutches* must be kept constantly clean; as, otherwise, these creatures will be frequently attacked with diseases.—The males, or bucks, should be parted from the *does*, or females, till

* Dickson's Agriculture, Vol. ii. p. 121.

the latter *kindle*; at which time one of the former may be allowed to six or eight of the latter; and a sufficient quantity of fresh hay should be provided, for the construction of a *bed*, or nest.

The females begin to breed when about six months old; being very prolific, they bring forth seven times in the year, from four to eight *conies* at a litter, after a gestation of thirty days; and, in the course of six weeks, the young rabbits are able to seek for their own food. The provision of these animals ought to consist of grass, cabbages, carrots, endive, clover-hay, and similar vegetables, which should be given them frequently, in a fresh, though not wet state; and, as soon as the young conies begin to disagree after being weaned, it will be necessary to separate them.

Rabbits are chiefly subject to two disorders, which, if they be not entirely attended to, generally prove fatal: 1. The *rot*, which is occasioned by feeding them with too great a proportion of green vegetables, or with such as were gathered before the dew or rain was evaporated. It may, however, be prevented by a strict attention to their food, and especially by mixing a certain portion of clover, or other hay, with green or moist plants. 2. A species of *madness*, which may be ascertained by their restlessness; as these animals roll themselves on the floor of their *hutches* in an uncouth manner, and hop about in odd postures. This distemper generally arises from rank feeding, and may be cured by keeping them *low*, and giving them tare, or spear-thistles, the *Carduus lanceolatus*, L.

The usual modes of catching wild rabbits are, by what is called *purse-nets*, and by ferrets; though they are sometimes coursed with small grey-hounds, or with spaniels trained up to the sport. Another method consists in *smoking* them out of their burrows, by burning sulphur and orpiment at the entrance. The deleterious fumes of these articles compel the animals to rush into the net spread for their reception; but, as their flesh may thus be rendered unwholesome, and a long time must elapse before other rabbits can be induced to enter the holes, such fetid ingredients ought never to be employed.

VI. BEEES.

ALTHOUGH these useful insects are not generally considered as a part of the farmer's live stock ; yet, as they require comparatively little trouble, attention, or capital to begin with, attempts may be made towards rearing them without risking much, if any loss. Bees, Mr. Young has remarked, are not so much attended to, by many farmers, as they ought to be : not a farm-house should be without bee-hives, as the trouble they give is very trifling ; and by *farmers small profits should not be neglected.**

In purchasing bee-stocks, it is desirable that the buyer should, if possible, be accompanied by a person well skilled in the value of bees, and should conduct himself with the utmost coolness. He should first examine the exterior of the hive : if the straw be decayed and rotten, the ligaments loose, and frequent blotches appear, which evidently show that it has been mended, the hive *must be rejected altogether*. On the contrary, if the hive be sound and perfect, he must then proceed to examine the interior. If the combs be black and ill-flavoured, it is a certain sign of an old hive ; but, if they be of a pale yellow it indicates a young hive. But, as fraudulent dealers sometimes add new borders of virgin wax, which gives the edges of old combs a light yellow cast, it will be necessary to look very carefully between the combs, as far at least as the bees will permit ; and if the interior part be favourable, to form the judgment accordingly. The number of queen-cells, appearing in a hive, will also indicate its age : and if these be numerous, there can be no doubt of its being an old one. The purchaser should likewise examine the combs as high as possible ; for it is in the upper part of the hives that the wax-moths begin their ravages. These vile insects, however, are rarely to be found in a new hive : but if the sides of the combs appear to be gnawed, the hive must be rejected, as no bees can prosper where the moths have once obtained entrance. The weight of a hive in February ought not to be less than 12 or 15lbs. ; and, if purchased in the autumn, not less than 30lbs.

* Farmer's Calendar, p. 292.

The best time for purchasing bee-stocks is, either in February, or in the swarming season; and it is always best to buy them from a distance, not from the immediate neighbourhood. And the health of the hive and fecundity of the queen-bee may easily be ascertained by the purchaser observing for a few minutes the number of bees that enter the hive loaded with farina, and whether an equal number leave it in a great hurry and bustle. If a loud humming noise be heard in the interior of the hive, it is a certain indication of its strength, and that its inhabitants are in a prosperous state.

The removal of swarms should take place in the evening after they have been hived; as they may then be carried to any distance without being affected by the motion of the carriage. Water carriage is always to be preferred where it can be obtained: but if they must be transported by land, the greatest care and attention will be necessary. The hive must be gently raised, if the board be not moveable, and be placed on a board in readiness for the purpose: the entrance should then be closed, to prevent any of the bees from coming out: but if the distance be great to which the hive is to be carried, care must be taken not to stop up the entrance *entirely*, as the bees would be in danger of suffocation. The entrance being properly closed, a sheet must then be wrapped round it, and tied in a knot at the top, through which a strong pole is passed. In this manner it is to be carried by two men, the hindermost one keeping it constantly steady, to prevent the combs from breaking; which will almost invariably be the case, when hives are transported on the head, especially during summer.

The best situation for arranging bee stocks is, two points towards the east and one towards the south, and in a warm valley near a stream at a distance from noise and offensive smells, and guarding carefully against south-west winds. Their produce will also be materially increased by placing the bees in the vicinity of a fine pasturage, whither they can frequently resort in the course of the day, by which means they will be enabled more speedily to fill their hives. Among the trees and other vegetables most frequently visited by these industrious insects, may be mentioned the Apple, Almond, Balm, Bugloss, Blackberry, Bell-flower, Bindweed, Spanish Broom, Sweet Briar, Alder-Buckthorn, Buckwheat, Buttercup, Borage, Box, Cherry, White and Red Clover, Chesnut, and Horse-Chesnut,

Currants, Elm, Elder, Furze, Gooseberry, Hawthorn, Laurel, Lavender, Lily, Lucerne, Lupine, Melilot, Mignonette, Rosemary, Lemon-Thyme, Golden Rod, and Heath. Indeed it is remarkable, that in the vicinity of large heaths more honey is produced than in any other part of the kingdom. The honey produced by Bees feeding on heath, is very brown, and is said not to produce such good prices as the finer sorts of honey. But the weight of the hives will be materially increased by transporting them to the vicinity of heaths; this practice is almost universally adopted on the continent. As an instance of the profit thus to be derived, it is stated, on respectable authority,* that a hive which, when taken to the vicinity of heath, weighed only *twelve pounds*, had, when brought home, increased *sixty pounds*, and the expense of removing, together with the sum paid to the cottager for allowing it so stand in his garden, did not amount to five shillings.

The hives of bees are made of various materials; but straw, and especially rye-straw is the best that can be employed. The hives in common use, because they are found to answer tolerably well, continue to be employed, though it is certain that other forms may be very advantageously given to them, both for the comfort of the bees, as well as for the profit of their owner. One of the most commodious hives, as well as simple in its construction, is that invented by Mr. Huish, who has long experienced its superior advantages over every other form of hive.

Aware of the disadvantages which are conspicuous in the construction of the various kinds of hives in common use, Mr. H.'s first object was to select the most suitable material, which, after various experiments, he found to be straw. The shape of the hive was his next consideration: and he ultimately decided upon the form of a flower-pot, (see Plate V. figure 1.) as possessing peculiar advantages, and particularly as it would enable him to take the honey without depriving the bees of life. Having obtained eight pieces of well-seasoned wood about three inches broad, and half an inch thick, he laid them at equal distances in the top of the hive (see Plate V. figure 2.); and having fastened them to the outer projecting band, which serves as their basis, he covered them with net-work, over which

* Mr. Huish, in his valuable "Treatise on the Nature, Economy, and Practical Management of Bees," p. 314.

he placed a circular board, the whole length of the hive. Thus were the bees to attempt to fasten their combs in the interstices, they would find the net-work; which, being an infirm foundation, would oblige them to construct the combs on the single boards. He had now given to the hive a *flat top*; but, as this would be injurious to the bees by preventing the evaporation of the steam arising from their bodies, in order to obviate this difficulty, he made six holes in the circular board which was placed upon the net, and which he closed with tin plates perforated with small holes, (see Plate V. figure 4.) The whole was covered with a convex cover of straw, manufactured in the same manner as the hive; the interior form of which facilitates the flowing of the vapours down the sides of the hive, and the exterior form prevents any rain from lodging on it. This cover is well plastered down, to prevent the admission of any light into the hive. At any time and season when honey-comb is required, or at the end of the season when Mr. Huish deprives his bees of their superfluous store, he opens the top and takes out the side-boards; from which having cut the honey-comb he replaces them in the hive, and observes that it will facilitate the operation to have some vacant boards ready to supply the places of the full ones. This operation is very easily and speedily performed: it has the advantage of not disturbing the middle combs, and Mr. H. has often deprived these bees of their honey without the loss of a single bee, excepting a few that left their stings in various parts of his dress.

In proof of the superior convenience derived from this mode of constructing hives, Mr. Huish states, that in August 1810 he obtained from one of these hives eighteen pounds of beautiful honey-comb; by the end of September the void was again filled, and he extracted ten pounds more, leaving sufficient to supply them throughout the winter. Figure 1. of Plate V. represents the hive as it appears on its proper stand; and in figure 3 is delineated one of the horizontal boards extracted from the hive, with the comb pendant from it.

Two very considerable advantages arise from the use of this hive:—in the first place, there is never any occasion to make any addition to the hive at the bottom; when the bees, by lying out in clusters, show that they stand in need of room: for the operation of depriving them of part of their combs from the top will give them that room which they require, and

which they will soon replenish with honey. The second advantage is, that the whole interior of the hive is open to the owner's inspection; who is thus enabled to examine the devastation of the moth, or to ascertain the presence of any other enemy.

In whatever situation the hives are placed, they should be protected from the winds, and in our variable climate from the south-west wind especially. In an apiary, the hives should always be placed in a right line; but should these be numerous, and the situation be not sufficiently capacious to admit them to be placed longitudinally, it is more advisable to place them one over another: and as a bee, on leaving the hive generally forms an angle of about forty-five degrees with the horizon, the hive ought therefore to be raised about two feet from the ground in order to protect it from humidity. If, however, the hives are to be placed in a double row, the hinder ones should be placed at such a distance from those in front, that, when the bees take their flight, no obstruction is offered to their ascent: at all events, if the situation will not allow the hives to be placed in a right line, Mr. Huish recommends that they should be ranged in the form of a chequer, thus:



By this method, the flight of bees in the hinder row of hives will not be obstructed by those which are in front.

No plan is more injurious than that which is frequently adopted, of placing several hives upon the same bench, and which, especially in the swarming season, is frequently attended with very destructive consequences; as the bees are liable to fall into the utmost confusion, besides which, the easy access that bees of one hive have to those of another, not seldom promotes quarrels and murderous battles. These inconveniences are completely avoided by placing each hive on a *single pedestal*; which has this further advantage over four-legged stools or benches, that it cannot be very easily removed, and of course the property of the bee-master is better secured from robbers. The pedestal employed and recommended by Mr. Huish is about three inches in diameter, through which a hole is bored

of sufficient magnitude to admit a chain of a tolerable size. He then places the machine over the hive, as represented in Plate V. figure 5: the two chains meet, and a good strong padlock being attached, the property is considered to be safe from depredators. But the board, on which the hive is to stand, ought to be *very firmly nailed* to the pedestal, and in rather a slanting direction, so as to give a fall to rain, and thus prevent the hive from being subject to humidity: and it should also be made of thoroughly seasoned wood, otherwise it will warp, and afford an easy admittance to wasps and other foes of the industrious bee, which will rarely enter a hive by the regular passage. The best method of preventing the bee-stand from warping, is to have two strips grooved in it, in a contrary direction to the grain of the wood of which the stand is made; thus the latter will always remain even.

In the spring, when a hive is well peopled with many thousands of young bees, a particular period arrives when they seek another asylum than that of the parent hive. An advanced guard, if the expression may be permitted, is first sent out to select a proper spot, where the new colony may settle; and, that being ascertained, the *swarm* (as the new colony is termed) goes forth to the appointed spot. The season for swarming varies in different countries; but in England the swarms generally appear in the months of May and June. The emigration of the colony, however, does not take place unless there be a young queen to perpetuate the empire which is about to be established.

Various signs have been indicated by which to ascertain the approach of a swarm for a few days before it actually takes place. They are as follow*:—1. The hanging of an extraordinary number of bees in clusters about the entrance of the hive; but this sign is to be observed with caution, as the cluster of bees sometimes happens when the heat of the interior of the hive is too great, or when they are straightened for room in which to work; 2. An apparent idleness, that reigns among the bees; 3. A particular noise made by the young queen-bee, similar to *chip, chip*, which is distinctly heard for two or three nights previous to the swarming; 4. An unusual bustle among the drones; 5. A sudden silence, succeeding a violent uproar;

* Huish on Bees, p. 214.

6. The continual motion of the wings of the bees that stand at the entrance; 7. Violent commotions at the entrance of the hives, and the bees crowding out in great numbers. As, however, these indications cannot *always* be depended upon, the most prudent method will be to appoint some *steady adult* to keep a regular watch from nine o'clock in the morning to three in the afternoon. On the departure of a swarm, the hive appears to be in the greatest commotion; the whole community appears in a state of emigration, and thousands are seen circling the air in every direction. The bees which first leave the hive, return, hover for an instant before it, and rise into the air; the whole swarm then quits the hive, attended by the queen, and in the first instance, repairs either to some previously chosen spot, or settles on the branch of an adjacent tree or bush. Every exertion should then be made to hive it, as the swarm will not continue there above two or three hours, particularly if the sun shine very strongly upon it; and, even when they are hived they should be covered with a sheet or table cloth to protect them from the solar rays.

The manner, in which a swarm is to be hived, must depend on circumstances: if the bees have settled on a tree or bush, it will be sufficient to place the hive beneath it, and with a bough or the wing of a goose to brush the insects into it; and it will add much to the security, as well as boldness and presence of mind, of the operator, to have some covering for the legs, hands, and face. His clothes ought not to be black, blue, brown, or of any other dark colour; as, when enraged they invariably fly to the hair, eye-lids, and other dark parts of the body.

In all operations on the interior of the hive, or in the management of swarms, the heads should be covered with a cap, over which Mr. Huish recommends a linen hood to be thrown, having a mask of iron wire, which is more commodious than glass, horse-hair, or gauze, through which it is difficult to respire. The hood should fall below the shoulders, that it may be fastened round the body, in order to prevent the bees from slipping beneath. (See Plate V. figure 6 and 7.) The gloves should be of the coarsest worsted, through which the sting cannot so easily penetrate as through leather; and should further be lengthened with linen so as to extend a con-

siderable way up the sleeves; and gaiters should be used for the covering of the legs.

Supposing the swarm to be hived in the morning (which is the general time of swarming), the hive must not be removed until late in the evening, that sufficient time may be allowed for the stragglers to return. The best inducements that can be offered to encourage a swarm to enter the hives are cleanliness, neatness, and the absence of all offensive smells: it does not appear that their settling is facilitated by retaining and following the very ancient practice of rubbing the hive with odorous herbs and honey.

It sometimes happens that a hive will send forth a second swarm: but it is difficult to ascertain the precise time of the flight of the *cast*, as it is in this case termed. If it takes place at all, it may generally be expected on the eighth or tenth day after the first swarm: as, however, some hives never throw a second swarm, this point may in some degree be ascertained by inspecting the hive immediately after the first swarm has departed. If the combs be bare and destitute of bees; if the supernumerary princesses be seen dead before the hive; or if the bees tear from the cells the nymphs of the drones, no second swarm is then to be expected: the contraries of these appearances indicate the probability of a second swarm. But though none of these signs should present themselves, Mr. Huish advises the proprietor attentively to watch his hive, from nine o'clock to about three, from the fifth to the twelfth day, after which time it will be needless to look for any swarm.

In general, it is preferable not to meddle with the swarms for two months after they are hived: but, if the day subsequent to their hiving be rainy, and the weather should prove wet for several following days, it becomes advisable to give the bees a little food; as the quantity of honey (about four pounds weight), brought by them from the parent hive, will by that time be nearly, if not wholly exhausted. The food should always be given them at night, to prevent any robbery being committed by other bees: very particular care, however, ought to be taken, in lifting a hive in which a swarm has been lately placed, that it be *gently* performed; as the combs, not having yet acquired a proper consistency, and being also loaded with

appear that the queen is wanting in the new hive, prompt mea-bees, are very apt to break,—a circumstance which causes great confusion in a hive.

When the population of a hive appears to be too large for its habitation, expedients have been resorted to for the purpose of detaching a portion of the bees, which is termed an *artificial swarm*.

Concerning the utility of artificial swarms, apiarians are by no means agreed; although there are various methods of procuring them. That recommended by Mr. Hnish as most preferable is as follows:—In the first place he opens the hive at the top; and, having removed the board and netting, he immediately applies the board delineated in Plate V. figure 8. This board is necessary, as, the lower part of the hive being smaller in diameter than the upper, no junction could be formed so exact as to prevent the bees from escaping at the sides. It has also this further advantage, that, as the bees generally inhabit the middle of the hive, their expulsion is more easily effected.

A box is then provided, fifteen inches square by seventeen inches in height: three of its sides are closed, and one open, having two cross bars, one at the top, and the other nine inches lower down. The upper part of the box is pierced six inches square in the middle, which is covered with wire work, so close as to prevent any of the bees from falling into the fumigating pan,* which being placed within the box, the hive is put upon it. When the smoke has driven the bees from the full hive into the empty one, which is soon ascertained by a loud humming noise, the upper hive may be gently raised: and when a sufficient number is supposed to have left the parent hive, the fumigating pan is removed, the upper hive is taken away, and placed upon a moveable board, and the old one is restored to its former position. In general, the queen bee will be found in the new hive: but as bees will not work without her, should it

* A common iron stew-pan, with a short wooden handle, the lid of which is perforated with holes and secured by a hinge, is the most convenient for this purpose, as the cover will prevent all danger of fire, and also the bees from falling into it. The material to be burnt in this vessel is linen, or dried calf's dung. To procure the latter, it must be gathered while fresh, and thrown against a wall exposed to the sun: it will soon become so thoroughly dry, that, in being removed, it may easily be reduced to a powder, in which state it is to be burnt.

sures should be taken to procure one, either from the parent hive or from some other that has swarmed once, as it is in the latter that supernumerary queens usually abound. Various expedients have been suggested for this purpose, for an account of which we must refer to Mr. Huish's Work already cited; and for the present would observe, that though artificial swarming may please the amateur, yet it cannot be generally adopted, nor will it tend to the ultimate advantage of the proprietor.

Cleanliness is of the utmost importance in an apiary: all noxious weeds should be carefully removed, nor should any rubbish be left in which the enemies of bees can conceal themselves. The planting of a *few* (and only a few) low trees or shrubs, in the vicinity of the apiary, will be found useful in arresting the flights of swarms, which frequently alight on espalier trees, or on currant and gooseberry bushes.

The common practice, in this country, in order to collect honey and wax, is to deprive the bees of life by suffocation;—a practice which, to say the least of it, is both unnecessary and cruel. It may be completely obviated by adopting the hive invented by Mr. Huish, and which has been already described.* Too much honey and wax must not be taken from them: sufficient ought to be left for the support of the hive during the winter. The safest way is to regulate the quantity to be left, by the apparent population of the hive. The process of deprivation Mr. H. recommends to be conducted in the following manner:—

Having ascertained the weight of the hive, and consequently the quantity of honey-comb to be extracted, the full hive is to be reverted, and an empty one be placed over it, as soon as the evening sets in: but particular care must be taken that the two hives be of the same diameter, for if they differ in their dimensions, it will be impossible to effect the driving of the bees. The hives being placed on each other, a sheet or large table-cloth must be tied round them at the point of junction, to prevent the bees from molesting the operator. The hives being thus arranged, the sides are to be gently beaten with a stick or the hand: but particular caution must be used to beat it on those parts to which the combs are attached, and which will be found parallel with the entrance of the hive. The ascent of the bees into the upper hive will be known by a loud humming

* See p. 554.

noise, indicating their pleasure on finding an asylum from their enemy: in a few minutes the whole community will have ascended; and the hive with the bees in it may be placed on the pedestal whence the full hive was removed. The latter is then to be taken into the house, and the operation commences of cutting out the honey-comb. A few bees, perhaps, will still be found, straggling among the combs: but these need not be regarded, for it is certain that the queen is among the bees left in the hive in the apiary, and these stragglers are too much intimidated to make use of their stings. The requisite quantity of comb being extracted, this opportunity should be embraced, to inspect the hive, and clear it of any obnoxious matter.

In cutting the comb, however, particular attention should be paid not to cut into two or three combs at once: but, the cutting of one having been commenced, it must be pursued to the top of the hive; without this precaution much loss and waste would result to the proprietor. The deprivation of the honey-comb being effected, the hive may be returned to its former position; and the hive containing the bees being reversed, and the deprived hive being placed over it, they may be left in that situation till the morning, when the bees will be found to have taken possession of their native hive. For other particulars relative to the feeding of bees, the treatment of their diseases, &c. &c. the reader is necessarily referred to Mr. Huish's interesting work so often cited in the course of this article. There is, however, one advantage resulting from the keeping of bees, which we cannot omit to mention, viz. that their produce in honey, wax, and mead (where this liquor is made), is almost entirely *clear profit*; as neither rents nor taxes attach upon bees, or bee-hives. Nor do they require a constant attendance, as other articles of improvement do: for a proper person might easily oversee, with a little assistance in swarming time, at least 500 bee-hives: and, as Nature has amply provided them with food, and with powers to provide it for themselves, they put their owners to little or no expense for that article.

VII.—FARM ACCOUNTS.

THE advantages of clear accounts are obvious in every other pursuit of life: yet, strange as it may appear, the making of a

few rough memoranda or figures, to yield a *gross* account of the general receipts and expenditures, usually constitutes the utmost efforts which are made by the majority of farmers who profess to keep accounts. Not unfrequently do men engage in agriculture, without much previous education, or even study and inquiry; and they conduct large concerns in it, without those accounts which are justly reckoned essential in every other business. To this unaccountable omission may be traced much of that uncertainty as to the real state of their affairs, with which industrious farmers are often perplexed, as well as of that loss which they often sustain. In order to supply this very material deficiency, the following outline of a Farming Account Book is offered to the attention of farmers and graziers :—

JOURNAL from.

State of Weather.

Monday.		Barom.	Thermom.	Wind.	Rain.	
Tuesday.						
Wednesday.						
Thursday.						
Friday.						
Saturday.						

Weekly State of LABOUR, &c. from

Names of Men and Horses.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	No. of Days.	Per Day.	£. s. d.		
Task Work.											
Horses.											
Daily Labors.											
Farm Servants.											

TABLE

To Cast up WAGES, by the Day, Week, Month, and Year.

By the Day.	By the Week.	By the Month.	By the Year.
s. d.	£. s. d.	£. s. d.	£. s. d.
0 1	0 0 7	0 2 4	1 10 5
0 2	0 1 2	0 4 8	3 0 10
0 3	0 1 9	0 7 0	4 11 3
0 4	0 2 4	0 9 4	6 1 8
0 5	0 2 11	0 11 8	7 12 1
0 6	0 3 6	0 14 0	9 2 6
0 7	0 4 1	0 16 4	10 12 11
0 8	0 4 8	0 18 8	12 3 4
0 9	0 5 3	1 1 0	13 13 9
0 10	0 5 10	1 3 4	15 4 2
0 11	0 6 5	1 5 8	16 14 7
1 0	0 7 0	1 8 0	18 5 0
2 0	0 14 0	2 16 0	36 10 0
3 0	1 1 0	4 4 0	54 15 0
4 0	1 8 0	5 12 0	73 0 0
5 0	1 15 0	7 0 0	91 5 0
6 0	2 2 0	8 8 0	109 10 0
7 0	2 9 0	9 16 0	127 15 0
8 0	2 16 0	11 4 0	146 0 0
9 0	3 3 0	12 12 0	164 5 0
10 0	3 10 0	14 0 0	182 10 0
11 0	3 17 0	15 8 0	200 15 0
12 0	4 4 0	16 16 0	219 0 0
13 0	4 11 0	18 4 0	237 5 0
14 0	4 18 0	19 12 0	255 10 0
15 0	5 5 0	21 0 0	273 15 0
16 0	5 12 0	22 8 0	292 0 0
17 0	5 19 0	23 16 0	310 5 0
18 0	6 6 0	25 4 0	328 10 0
19 0	6 13 0	26 12 0	346 15 0
20 0	7 0 0	28 0 0	365 0 0

A TABLE
For calculating the Expense of Dibbling, Hoeing, Sowing, Reaping, Mowing, &c. &c. by 10, 15, 20, 30 Poles,
the Rood, and Acre, from Two Shillings to Two Pounds; cast up to the Fraction of a Farthing.

Total Sum per Acre.		Ten Perches or Poles.		Fifteen Poles.		20 Poles.		30 Poles.		Rood.		Acre.	
£.	s. d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	£.	s. d.
at 0	2 0	0	1½,000	0	2½,000	0	3,000	0	4½,000	0	6	0	2 0
	2 6	0	1½, 50	0	2½, 25	0	3½, 00	0	5½, 50	0	7½	0	2 6
	3 0	0	2½,000	0	3½,500	0	4½,000	0	6½,000	0	9	0	3 0
	3 6	0	2½,500	0	3½,750	0	5½,000	0	7½,000	0	10½	0	3 6
	4 0	0	3,000	0	4½,000	0	6,000	0	9,000	1	0	0	4 0
	4 6	0	3½,500	0	5,250	0	6½,000	0	10,500	1	1½	0	4 6
	5 0	0	4,000	0	5½,500	0	7½,000	0	11,000	1	3	0	5 0
	5 6	0	4,500	0	6,750	0	8½,000	1	11,500	1	4½	0	5 6
	6 0	0	4½,000	0	6½,000	0	9,000	1	12,000	1	6	0	6 0
	6 6	0	4½,500	0	6½,300	0	9½,000	1	12,500	1	7½	0	6 6
	7 0	0	5,000	0	7,500	0	10½,000	1	13,000	1	9	0	7 0
	7 6	0	5½,500	0	8½,750	0	11½,000	1	14,500	1	10½	0	7 6
	8 0	0	6,000	0	9,000	1	0,000	1	15,000	2	0	0	8 0
	8 6	0	6½,500	0	9½,250	1	0½,000	1	16,500	2	0½,450	0	8 6
	9 0	0	6½,000	0	10,500	1	0½,000	1	17,000	2	3	0	9 0
	9 6	0	7,500	0	10½,750	1	2½,000	1	18,000	2	4½	0	9 6
	10 0	0	7½,000	0	11½,000	1	3,000	1	19,000	2	6	0	10 0
	15 0	0	11½,000	1	14,500	1	10½,000	2	24,000	3	9	0	15 0
	1 0 0	1	3,000	1	10½,000	2	6,000	3	29,000	5	0	0	1 0 0
	1 5 0	1	6½,500	2	4,500	3	1½,000	4	34,000	6	3	0	1 5 0
	1 10 0	1	10½,000	2	9,000	3	9,000	5	39,000	7	6	0	1 10 0
	1 15 0	2	2½,000	3	3,000	4	4½,000	6	44,000	8	9	0	1 15 0
2	0 0	2	6	3	9,000	5	0,000	7	49,000	10	0	0	2 0 0

VIII. MONTHLY CALENDAR

Of Work to be done throughout the year, with references to those pages in the present Volume, where the respective operations are noticed or described.

OCTOBER.*

HIRE and stock Farms (pp. 27—32). INSURE PROPERTY without delay. Hire servants.† Sow winter tares (473). Dig and plough up root crops (479). Manure grass lands (372, 374, 377). Sow rye (482). Lay up fallows (298—300). Manure and plough for pease (484), beans, (485), barley, and oats (483). Scour out drains, *ditches*, and other water-courses (406). Collect and convey decayed and fallen leaves to the yards, that they may be saturated with urine for manure (381, 382). Water the meadows (320—339). Get the straw-yards, cow-houses, and stables, ready for the cattle, as this is the last month of their continuing abroad. Put fattening beasts to cabbages, carrots, or turnips (142—145); cows in milk, to cabbages, in a separate yard (120); dry cows to chaff; and the teams (153), to chaff, hay, mixed fodder, or other dry food. Fatten swine (183—185). Put rams to ewes (73, 74). Destroy weeds (306—313). Plant quicksets (397, and following.) October, it should be remarked, is one of the busiest seasons in the whole year; and (Mr. A. Young sen. has observed) comprises that period of good or tolerable weather which usually takes place before most field business is stopped by rain, snow,

* As the farmer's year, from custom, and in most instances from convenience, almost generally commences from Michaelmas, the present Calendar has been drawn up with reference to that circumstance.

† As in many instances farmers do not give characters, and it is not always easy to form a quick and correct judgment of the accounts given by individuals who want situations, it has been suggested, with a view to obviate this difficulty, that farmers might have, *among themselves ONLY*, printed circulating letters, requiring merely their signature, and containing the moral character of the servant; his skill in business, careful or slovenly mode of doing it, length of time he has been employed, age, constitution and other requisite information.

or frost; hence it may not unfrequently happen, that work, here minuted as requiring to be done, must be finished in the following month. Whatever business, therefore, the farmer cannot execute in October, he must finish as soon as he can in November.

NOVEMBER.

Finish ploughing fallows (299, 300). Continue watering the meadows (320—339). Dig and cart manures (384 & foll.) Destroy ant and mole hills (304, 305, 418, *note*), and level pastures (408, 409). Repair fences (404, 405), and continue to scour out ditches (406). Hollow-drain wet lands (287, 288). Cut down wood (313). Buy in store-pigs for the yard, and put up bacon hogs to fatten (182). Kill fat beasts, and swine already fattened off for curing bacon (187). Select young calves to breed from (47). Steam roots (106, 107). Keep fattening sheep on turnips or cabbages, and lean ones on the remnant of summer grass, and on sheep-walks (163 and following). Stack and preserve carrots (if not already done, 479), and turnips from frost (491—494).

DECEMBER.

As bad weather usually sets in this month, (if not before) farmers should keep a strict watch for fine open weather, to do all the out-door work remaining unfinished. Carefully tend the farm-yards, cow-houses, stables, and cattle sheds. Pare and burn old ley-grounds (301—303). Moss-harrow and level pastures and meadows (406, 407). Attend particularly to ewes, near the time of lambing (74—76). Occasionally give fat sheep some hay. Well litter swine. As, at this season, the teams are generally unemployed, let every opportunity, offered by open weather, be diligently employed in repairing fences, (404, 405), cleansing drains, ditches, &c. (406). Continue to water the meadows (320—339). Sell house-lambs (84—86). Put boars to sows for spring litters (87). Sell poultry (541 and foll.) Finish ploughing for spring crops, left undone in October or November. Settle farm accounts (561—564).

JANUARY.

Carefully watch cows, near the time of calving (42). Put ewes that have already lambed, or are near the time of lambing, into rouen (77). Fatten beasts (142 & foll.) Marl lands (373—375). Repair fences, and hedges, by ploughing or otherwise (404, 405). Drain wet lands (286 & foll.) Sow pease (484), and beans (485). Examine water furrows and water meadows (320—339). House weanling calves and foals. Cut and spread ant-hills (305). Finish killing and curing bacon, if not already done (187, 188). Burn lime (370, 371).

FEBRUARY.

Plough such lands as are sufficiently dry, for the earliest crops (291, 292). Sow Furze (482). Sow beans (485), and pease (484). Sow cabbages (477), rye (482), oats (483). Continue to repair hedges (404). Lay up meadows and pastures about Candlemas (129). Manure grass-lands (374). Attend to ewes lambing (74—76). Water meadows (317 & foll.) Sow parsnips (480), and saintfoin (469). Sell off fat beasts (158). Sell fat lambs, and fatten ewes on clover.

MARCH.

Turn sheep into old watered meadows (435). Shut up meadows and pastures for grass-crops. Watch cows near calving (42), and ewes near lambing (74—76). Turn out calves dropped the preceding month among the fattening beasts. Geld lambs (78). Finish sowing beans (485), pease (484), and oats (483), left unsown. Watch sows about to farrow, especially young ones (88). Buy lean beasts, to fatten for winter consumption (128, 129). Soil cattle (132 and foll.) Dispose of fat beasts (158), and wethers fattened in winter (164). Repair hedges (404, 405). Sow parsnips (480). Sow tares (473), white beet (475), turnip-cabbage (477), spring-rye (482), and oats (483), pease (484), potatoes (486), saintfoin (469), and lucerne

(466—468). Sow carrots (478), furze (482), and cichory (472). Feed new lays (129). About the end of this month sow the common clover (466). Brew beer. Kill no bacon hogs after this month. Pick stones off the land (305). Settle Farm-Accounts (561—564).

APRIL.

Early this month finish sowing oats (483), and tares (473). Sow buckwheat (481), furze (482), lucerne (466), saintfoin (469), rye-grass (453), clovers (465), and hay-seeds. Attend to cows calving (42), and ewes lambing (74—76). Castrate lambs (78), and pigs (88, 89). Soil cattle (132 & foll.) Sell fat stock (153). Put mares to stallions (519). Turn cattle into pastures (410). Put sheep into water-meadows. Attend to mares foaling (519). Destroy ant-hills (304, 305), and mole-hills. Hoe potatoes, and carrots. Finish repairing fences (404). Sow burnet (471).

MAY.

Put bulls to cows (41, 42), and boars to sows (87). Wean young pigs of the first litter (88). Finish sowing buckwheat (481). Sow burnet (471), lucerne (466), saintfoin (469), oats (483), turnips for winter use (488). Watch mares foaling (519). Early this month, cross-harrow fallows (301). Hoe early planted potatoes and plant out potatoes for winter consumption. Turn cattle into pastures (409, 410). Graze pastures laid to rest at Candlemas, and shut up such as are to be fed off at Midsummer (129). Bleed horned cattle, if needful. Purchase wethers (two or three shear) to be fattened off during winter-months (164). Pare and burn (301—303). Water meadows (318—346). Destroy moles and other vermin (304, 418). Drain swampy and boggy land (286 & foll.) Cut, dry, and house turf for winter fuel. Mow tares and lucerne.

JUNE.

Put bulls to cows (41, 42). Sow turnips (488). Attend to the cabbage crops (477, 478). Dig fossile matures (364 and

following). Wean lambs (77). Shear sheep (78—80). Dispose of fat stock (157—159). Soil cattle (192). Clean out ponds, and prepare the mud for manure (377). Pare and burn (301—303). Mow grass-lands (438). Make hay (439—449). Mow rye-grass (453), and saintfoin (469, 470). Continue to get in turf for winter fuel. Settle Farm-Accounts (561—564).

JULY.

Put bulls to cows (41, 42). Finish the weaning of lambs (77). Sow burnet (471). Shear sheep, if the month of June has been too wet or cool (78). Hand-hoe turnips (488) already planted. Sow cole-seed (477). Weed cabbages, and hoe those planted in June, early in this month. Hoe carrots (479), and parsnips (480). Finish mowing grass-lands (438). Mow lucerne (468, 469). Finish hay-making (439—449). Hoe lucerne (468). Fold sheep (167, 168). Cut early pease (484). Pare and burn (301—304). Continue clearing out ponds, and prepare the mud for manure (377). Reap early rye about the end of this month (482). Plough fallows (299, 300). Shut up rouen (451).

AUGUST.

Reap and mow every kind of grain and pulse as they ripen. Sow rape (477), turnips (488), vetches (473), and burnet (471) for winter use. Set the flocks, and sell off fat sheep (84). Watch sows (particularly young ones), near the time of farrowing (88). Sow grass-seeds (419—431). Transplant lucerne (466). Weed potatoes by the hand, if the horse-hoe cannot reach them (486, 487). Sow cabbage-seed for plants to be transplanted in the following April (478). Cut lucerne (468). Turn sheep into saintfoin cut in June (469). Sell spare lambs (84). Lay down lands to grass (419—430).

SEPTEMBER.

Sell off spare fat stock (158). Put rams to ewes, for early lambs (73). Geld pigs, farrowed in August (88). Wean and

castrate foals (520). Purchase half-fed sheep and beasts for winter-fattening (127, 128). Manure grass-lands (322 & foll.) Scarify grass-lands (262). Turn cows and fatting beasts into saintfoin rouen. Sow winter tares (473), and winter-rye (482). Turn out swine to pick up acorns, and put up bacon-hogs to fatten (182 & foll.) Keep cattle out of lands, newly laid down to grass. Examine accounts (561—564.)

I N D E X.

ACHILLEA millefolium, see Yarrow.
 After-grass, see Rouse.
 After-math, see Rouse.
 Age of Horses, how to ascertain, 18—22.
 Agriculture, superior value of, to manufactures, page 36. Advantages derived from the use of oxen in it, 66, 67.
Agrostis stolonifera, see Creeping Bent-grass.
 Alderney, or French breed of Cattle, specific characters of, 6.
Alopecurus pratensis, see Meadow Fox-tail.
Alopecurus geniculatus, see Flote Fox-tail.
 American mode of rearing calves, 53. Of irrigating lands, 339, 340. Of forming hedges with the Cockspur Thorn, 402, 403.
 Analysis of soils, 577, 278.
 Anderson, Dr., hints of, on carriages employed in husbandry, 234. Suggestion of, respecting hoeing, 284. His system of draining uplands described, 295. Remarks of, on the use of crag as manure, 364. His method of making hay commended, 444. His observations on milk and butter, 498 and following.
 Animals, remarks on, previous to alterations in the weather, 190.
 Animal Manures, 359. Dung, *ib.* 360. Urine, 361. Tallow-chandlers waste, 362. Fish, *ib.* Bones, 363. Horn shavings, *ib.* Damaged wool, 363, 364.
 Annual pea, an excellent food for milk cows, 456.
 Ant-hills an impediment to the use of the scythe, best mode of removing them, 304, 305. Process for destroying them recommended by Mr. Marshall, 418.
Anthoxanthum odoratum, see Spring-grass.
 Aquatic plants, general description of the different sorts of, for cattle, 463.
 Artichoke, (Jerusalem), culture and uses of, 474.
 Artificial grasses, concise account of the best, and other vegetables cultivated and considered in that light, 464—474.
 Ashes, vegetable, for what soils most effectual, 346. Atmosphere, changes of the, indicated by various signs, 191.
Avena clatior, see Tall Oat grass.
Avena sativensis, see Yellow Oat-grass.
Avena sativa, see Oats.

B

Bacon, different modes of curing, 167, 168.
 Baker, Mr., his improved weed-extirpator, 311.
 Bakewell, Mr. (of Dishley) his science in rearing cattle, 28, 41. His ideas of folding sheep, 168. His remarks on the cure of the foot-rot, 232. Manner of increasing the quantity of manures, 381.
 Bakewell (Mr. Robert) observations of, on improving the fineness of wool, 533—536.
 Banks, Sir J., remedy communicated by, in the

affection of sheep with the scab, 226. His remarks on the effect produced by the *equisetum* on drains, 297.
 Barns, advantages in the building of, 101—103.
 Beans, culture of, 465.
 Bedford, Dukes of, their exertions in rural science, 37.
 Bees, observations on purchasing and removing, 551. Best situations for, 552. Vegetables most agreeable to, *ib.* Form of Hives, and best mode of taking honey, 553—555, 560. Hiving of swarms, 556—559. Advantages resulting from the rearing of, 561.
 Beet, common red, nutritive qualities of that vegetable for cattle, 146. Its culture, 475.
 Berkshire breed of Swine, characteristic description of, 23.
 Beverstone Plough, description of, 249, 250.
 Billingsley, Mr., remarks on the advantages derived from ploughing with oxen, 67.
 Black water, description and fatality of the, to lambs; treatment of the cattle attacked by it, 229.
 Bleeding of calves, 54.
 Blindness in sheep, treatment of, 208, 209.
 Blood, the most effectual remedy for that dangerous malady in sheep, 209.
 Bloody-urine, see Red-water.
 Blossoming of Ewes, explanation of the term, 75.
 Blown, see Hoven.
 Bogs, draining of, 289—292.
 Bones, unboiled, to what lands they are best adapted as manure, 363.
 Boodley, Mr., his remarks on the management of composts, 379.
 Borecole, culture and uses of, 476.
 Boswell, Mr., observations of, on watering meadows, 320, 322, 329, 330—336. His advice relative to hay-making, 443.
 Bowler, Mr., improved churn invented by, 275—277.
 Brake-barrow described, 267.
 Breaze, see Ox-fly.
 Bridgewater, Duke of, his valuable invention of the drain-plough, 259.
 Brocks, their utility in Agriculture pointed out, 332.
 Bruising-mills, improved, description of, 245.
 Buck-wheat, culture of, 481.
 Bull for breeding, description of the most proper, 33. His attainment of puberty, 34. His existence, general duration of, *ib.* Utility derived from training him to labour, *ib.* Contrivance for preventing mischief by, 35. Long-horned and short-horned, difference and excellence of, 36. Dishley breed of, described, 36.
 Burnett, its great utility, 119. Its culture and uses, 471.
 Burning of land, see Firing.

INDEX.

Bush-farrow, its structure described, 267.
 Bush-vetch, worthy the attention of agriculturists, 470. Opinions of various authors on, *ib.* 471.
 Butter, the making and preserving, described, 505—505.
 Byres or Feeding Houses, observations on the structures of, 94—98.

C

Cabbages, service of, to milch kine, 119. Remarks on their use for fattening cattle, 141. Their culture, 475, 477.
 Calbed, falling down of the, management recommended in that state, 45.
 Calves, observations on, 103. Construction, 104. Calves, natural position of, while in the uterus, 43. Unnatural position of, *ib.* Treatment of, from their birth, 46. Different modes of feeding them, *ib.* Preferable diet for them, *ib.* Their suckling prevented, *ib.* and note. Pasture for, its quality described, *ib.* Selection of, for breeding, labour, or feeding, 47. Substitutes for milk recommended for calves, their administration, 48 & seq. Turning out to grass, time for, *ib.* Method of rearing them by Mr. Crook, 50. Their treatment in the north of England, *ib.* Manner of rearing them in Cumberland, *ib.* Norfolk practice, *ib.* Manner of rearing them in Holland, 52. Mode of rearing them near Boston, in America, 53. Custom of Mr. Clift, *ib.* Feeding them, necessity of regularity in, *ib.* Their fattening, method of, 54. Cleanliness in rearing, necessity of, *ib.* Custom of bleeding them, *ib.* Treatment of those destined for draught, *ib.* Best time for castration, manner of performing that operation, and subsequent treatment, *ib.* 55. Fat, best method of estimating their value, 159. The principal diseases of, 206. Account of the cords, *ib.* Cough, 207, guttie *ib.* Scouring or looseness, *ib.* Shoote, 208.
 Calving, see Cow.
 Camnock-Heath, sheep, account of, 11.
 Campbell, Mr., his remarks on the use of potatoes for stall-feeding, 147. His improvement of the common ploughs, 248.
 Capital, importance of, to farmers, 27.
 Car, the improved Irish, account of, 235, 236.
 Carrots, a nutriment for cows, 119. Excellences of that vegetable, 141. Their average produce, 154. Culture of, and how stored for winter use, 478, 479.
 Carts, one-horse cart of Mr. Young, 237. Or Lord Robert Seymour, 238. Lord Somerville's Drag-cart, 239, 240.
 Cart-grasse, improved, recipe for, 242.
 Cart-house, account of its construction, 103.
 Cartwright, (Dr.) experiments of, on feeding sheep with brown sugar, 171—176.
 Castration of calves, how to be performed, 54, 55. Of lambs, best time for, 78.
 Catch-meadows, comparison of them with float-meadows, 328.
 Catch-work, definition of the term, 326.
 Cattle, descriptive sketches of the different breeds of, reared in the British islands, 1. Wild race, *ib.* Devonshire breed, 2. Herefordshire, *ib.* Sussex, 3. Dutch, or Short-boned breed, *ib.* Lancashire, 4. Galloway, or polled, 5. Highland breed, or kyloes, 6. Alderney or French breed, *ib.* Lowland breed, 7. Welch breed, *ib.*
 Cattle in general, necessity of caution in the purchase of, 27. Mode of valuation by the eye and

touch, 28. Rules to be observed in the selection, *ib.* Proportions requisite for working, *ib.* Beauty of shape, its consideration, *ib.* Utility of form, its importance, 29. Flesh, texture of, its knowledge requisite, *ib.* Necessity of care in the rearing of, description of animals to breed from, 29, 30. Attention requisite in the purchase, according to the difference of soil, 30. Various remarks on the same subject, *ib.* 31, 32. Improvement of, in latter years, 37. Exhibition of, at Little Rollright, *ib.* Horned cattle, their difference of breed, advantages of, *ib.* Necessity of caution in the breed of, 38. The Holderness breed chiefly prevalent in the vicinity of the metropolis, 39. Irish breed, their characteristics, 38, 39. Small, preferable, to take fat, 124. Devonshire, remarks on, 125. Necessity of selecting a suitable soil for their grazing, *ib.* Superiority of spayed heifers and oxen for grazing, *ib.* 126. Which sorts best for grazing, *ib.* Observations on the different methods of feeding and fattening, 127. Observations on feeding them with grass, *ib.* Necessity of having a variety of cattle on pasture ground, precautions in putting that into execution, 128, 129. Strictures on soiling or stall-feeding cattle, 132—139. Turnip-fattening of, described, 142—146. Substitution of different vegetables for fattening, 146—148. Remarks on the use of oil-cake, and manner of compounding it with other substances, 149. Improved methods of fattening, 150—152, & seq. The influence of the atmosphere on their health, 151. Their diseases, 193—208. Different names given to neat cattle, 125, 126, note. Tables for ascertaining their weights and values, 161, 162.
 Chaff-cutters, observations on the different, 242. Mr. Salmon's described, 242, 243. Mr. Macdougall's, 244.
 Chalk, treatment of land abounding in, 233. On what soil, and in what manner, best employed as a manure, 265. Why injurious to wood, 80. Grasses proper for chalk soils, 421.
 Chambers, Mr., contrivance of, for preventing haystacks from taking fire, 448, 449.
 Cheese, proper season for making, 505. Preparing the rennet, 506, 507. Cheshire cheese, how made, *ib.* Dunlop cheese, 509. Gloucester cheese, 510. Stilton cheese, *ib.* Skim cheese, 511. Cream cheese, *ib.* Wiltshire cheese, 512. Green cheese, *ib.* Preservation of cheese, 513.
 Cheviot sheep, description of, 11.
 Chinese, or black breed of Swine described, 23.
 Churns, improved, of Messrs. Wright and Co. 272. Mr. Bowler's improved churn, 273—275.
 Clobory, the culture and qualities of, described, 471, 472.
 Clay, manner of employing it on land for the purpose of obtaining abundant and luxuriant crops, 364. The nature of, described; manner of improving such land, 680. Manner best adapted to the culture of, *ib.* Remarks on its tillage, 221. Grasses proper for clay soils, 419.
 Cleanliness with cows indispensable, 44. Of calves, 54. Its importance in rearing of calves, &c. *ib.* And in feeding cattle, 135.
 Cleveland Boys, a breed of Horses described, 16.
 Clift, Mr., his mode of feeding calves, 53.
 Clipping of sheep, 80, 81.
 Close, Rev. Mr., remarks of, on the great advantages obtained by the soiling of cattle, 138. Table for manuring lands by, 390.
 Close-feeding of sheep, explanation of the meaning of that expression, 167.
 Clover, remarks on, 89. Common, best manner

INDEX.

- of cultivating, described, 466. Red perennial, by what means its culture best promoted, 465. Hop-clover, *ib.* White Clover, *ib.*
- Clydesdale breed of Horses, described, 16.
- Coal-mines, advantages derived from their use as a manure, 365.
- Cock's-foot dactylis, diversity of opinion held by eminent botanists and agriculturists concerning the properties of, 462.
- Colds, their influence on cattle; treatment of those affected by them, 194.
- Colic, or gripes, symptoms and method of cure described, 194.
- Colts, their treatment explained, 520.
- Coltsfoot, a pernicious weed, how to extirpate, 512.
- Composts, and Compound Manures, management of, 378—380. Compost of peat-moss and dung, preparation of, 347—354.
- Cooper, J., construction of the racks in his stails explained, 102. His new contrivance for distributing water in a farm-yard, 108.
- Cords, description of that malady; treatment recommended to prevent its occurrence, 206.
- Cornish Wain, description of, 240.
- Costiveness, in colic, purge recommended for, 194.
- Cotting of sheep, advantages derived from that system, 163, 169.
- Cotswold Sheep, specific character of, 9.
- Cough, affection of cows by, remedy for its removal, 203. The susceptibility of calves to that affection explained, and remedies for its cure, 207.
- Cows, perfect as milch kine, signs of, 39. Holderiness, the breed of, prevalent in the vicinity of the metropolis, *ib.* Their kindliness of skin considered, 40. Their importance considered, *ib.* Arrival of, at the age of puberty, 41. Proper time for their copulation, *ib.* Conception of, *ib.* Attention requisite after copulation, 42. Pernicious effect of administering provocatives, &c. &c. *ib.* Proper time of drying up the milk, *ib.* Time of gestation, *ib.* Barrenness of, *ib.* Their treatment during gestation, *ib.* Treatment after calving, 43, 44. Assistance necessary on such occasions, *ib.* Premature calving, *ib.* Food, quality of proper, after calving, 44. Falling down of the calf-bed, how to be treated, 45. Pasture for, its effect on their milk, 117. Their treatment in summer and in winter, 118, 119. London methods of feeding, and remarks on them, &c. 120. Stall feeding of, 121, 122. Their partiality for the water-crow-foot, with a description of its effects, 164. Account of the diseases peculiar to, 203—205. See *Cattle*.
- Cow-sheds, their best site, 118.
- Crag, the fertilizing properties of, detailed, 364.
- Cream, new method of removing ill-flavour from, 493, note. Management of, 493, 500.
- Cream-cheese, manner of making and preserving, 511.
- Creeping bent-grass, worthy of the attention of the experimental farmer, 457, 458.
- Creeping Poa, see Flat-stalked Poa.
- Crook, Mr., his method of rearing and fattening calves, 50, and note.
- Crow-garlic, its injury to milk, 117.
- Culley, Messrs., their employment of oxen, 62. On sheep, 77. Mr. G. Culley's salve for the foot-rot, 212.
- Camming, Mr., experiments on wheels, 226.
- Cur-dog, characteristics and qualities of the, 517.
- Curtis, Mr., his directions for obtaining grass seeds of a good quality, 413—415. What grasses he particularly recommends in the laying down land in order to form a good meadow, 423, 429. His remarks on Meadow-fescue, 454. On meadow Fox-tail, 454. On smooth-stalked Poa, 455. On Sweet-scented Spring grass, *ib.*
- Curwen, Mr., his successful feeding of cows, 122.
- Cynosurus cristatus*, see Crested Dog's tail.
- Cynosurus ceruleus*, see Blue Dog's-tail grass.
- ## D
- Dactylis glomerata*, see Cock's-foot.
- Dairy, observations on the economy and management of the, and situation and buildings proper for it, 495, 496. Dairy utensils, 497.
- Darnel, observations on the culture of, in England, and its application as food for sheep, 453.
- Dartmoor breed of sheep, specific character of, 9, 10.
- Darwin, Dr., his plan for forming dunghills, 111. Observations of, on the causes and cure of the rot, 216. His statement of the beneficial consequences resulting from following, 236.
- Davis, Mr., observation of, respecting the selection of land for grass, &c. 411, 412.
- Davy, Sir H., observation of, on the washing of sheep, 80.
- De Vaux (Cadet) his improvement in stinking wells, 81.
- Devonshire breed of cattle, specific characters of, 2. Of sheep, 10, 11.
- Diseases of cattle in general, 193. Colds, 194. Colic or gripes, *ib.* Foal, 195. Hoven or blown, *ib.* 199. Looseness or scouring, 199. Panting evil, 200. Poisons, 201. Red-water or bloody urine, *ib.* The staggers, 202. Wounds, *ib.*
- Diseases of cows.—Cough, 203. Puerperal or milk fever, 204. Affections of the udder, 205.
- Diseases of calves.—The Cords, 206. Cough, 207. Guttie, *ib.* Scouring or looseness, *ib.* The Shoote, 208.
- Diseases of sheep.—Blindness, 208. Blood, 209. Dunt, *ib.* Flux, 210. Fly, *ib.* Foot-halt, 211. Foot-rot, *ib.* Gall or scour, 214. Hoven or blown, *ib.* Hanger-rot, *ib.* Felt-rot, *ib.* Red-water, *ib.* Rickets, 215. Rot, 216—225. Rubbers, or Ruhs, 225. Scab, *ib.* 226. Tick, 227. Affections of the udders of ewes, 228. White Scour, *ib.* Wounds, *ib.* 229.
- Diseases of lambs.—Black and red water, 229. Skit, 230.
- Diseases of swine.—Gargut, 230. Fever, 231. Disorders of the lungs, *ib.* Mange, *ib.* Mewsie, *ib.* Murrain, 232.
- Disley breed of cattle, observations on the, 57.
- Disley breed of sheep, 8. Specific characters of, *ib.*
- Distemper, see Murrain.
- Ditches, observations on, 405, 406.
- Dock, the common, how to extirpate, 510.
- Docking of sheep, remarks on the practice of, 179.
- Dogs, general remarks on their utility, 515. Shepherd's dog, *ib.* Cur-dog, 516. The Prussian breed, 517.
- Dog's-tail, crested, recommended as a wholesome food for sheep, 452. Blue dog's-tail, value of, 463.
- Dorsetshire breed of sheep, specific characters of, 13. Uncommonly prolific, 72.

INDEX.

Drag cart, construction of, 239.
 Drags, observations on, 273.
 Draining, the importance of, 286. Account of hollow draining, 287. Of bogs described, 289. Sheep pastures, simple method of, 292. Of uplands, 293—295.
 Drain-ploughs, descriptions of, 258, 259.
 Drains, earth, method of making, 288. Advantages derived from stone drains, *ib.* Remarks on their use for discharging the water from the land, 286—296.
 Draught, best mode of training calves for, 54. Steadiness of oxen in, 64.
 Drill-ploughs, account of, 253. Mr. Tull's, *ib.* Mr. Young's, *ib.* Mr. Amos's, *ib.* Mr. Cook's, *ib.* Mr. Munings's turnip-drill, 254. Mr. Knight's turnip-drill, 255, 256. Hand-drill, 257.
 Dublin Society, prizes of the, for ploughing, gained by oxen, 63.
 Duckett, Mr., improvement of ploughs by, 251. Improvement of the hoe by, 263.
 Dudgeon, Mr., improved grahler of, 261, 262, note.
 Dun-faced breed of sheep, account of, 12.
 Dung, most advantageous manner of obtaining it in good quality and quantity, 156. In general, the fertilizing properties of, considered, 350, 360.
 Dung-heaps, remarks on, 112.
 Dung-hills, their importance, 111. Forming them, best mode of, *ib.* The most proper site for, 112, 113.
 Dung-meets, Middlesex, how formed, 112, 113.
 Dunlop breed of cattle, 7.
 Duns, Suffolk, good qualities of the breed of, 38. Descriptive characters of, 5.
 Dunt, a disorder of sheep, treatment of, 209, 210. Preventives used on the Continent against it, *ib.*
 Dutch, their method of rearing calves, 52. Dutch hoe described, 263, 264.
 Dutch, or Short-horned breed, specific characters of, 3. Peculiar advantages of, *ib.* 4.

E

Eager, Mr., contrivance of, for the relief of hoven colic, 197, 198.
 Earth, appearance of the, considered as a prognostic of changes in the weather, 191.
 Earth-hanks, in what districts chiefly employed, and manner of forming them described, 394.
 Earth-drains, description of, and mode of making, 288.
 Eccleston, Mr., his description of a useful implement used in draining, 296.
 Edget, see Scarifiers.
 Elkington, Mr., the system of draining uplands described by, 295.
Equisetum polustre, its propensity to choke drains, 297.
 Ewes, their time for breeding, 71. Choice of, 72. Their prolific nature, *ib.* and note. Their time of gestation, *ib.* Treatment of, before and during the time of yeaming, 74. Different modes of treating them in wet or stormy weather, 75. Or glimmer-hogs, an appellation denoting female sheep, 103.
 Exmoor breed of sheep, description of, 12.

F

Falling-down of the calf-beet, how treated, 45.
 Fallowing, remarks on the alterations produced

by, 298. Management of fallows, *ib.* 299—301.
 Farm accounts, observations on, 561—564.
 Farm-cottages, observations on, 116.
 Farm-house, remarks on the proper situation and structure of the, average calculation of the expenses of building it, &c. 90, 91. Description of the interior, and covering of the roof, 92, 93.
 Farm-offices, importance of a judicious arrangement and proportion in, 90.
 Fattening of calves, 54.
 Fattening of cattle, general strictures on, 127—146.
 Feeding, importance of this object, 155, 156. General observations on the feeding of cattle, 127—146.
 Feeding-houses, observations on the structure of, 94—98.
 Fences, observations on, 394. Earth-hanks, *ib.* Walls, 395. Hedges, 396—405. Ditches, *ib.* Gates, 406, 407.
 Fens, Mr. Tollet's plans for the management of, 424—436.
Festuca duricuscula, see Hard-fescue.
Festuca sulcata, see Flote-fescue.
Festuca ovina, see Sheep-fescue.
Festuca pratensis, see Meadow-fescue.
 Fever, in swine, treatment of, 231.
 Fields, size and shape of, 392, 393.
 Fir-tops, advantageous employment of, as a substitute for other articles of winter fodder, 146, 147.
 Florin grass, culture and management of, 457.
 Fish, the manner of using these animal substances as manure, described, 362, 363.
 Fitzherbert, Judge, opinion of, respecting the preference of oxen to horses in agriculture, 60.
 Flax-water, its utility as manure, 376.
 Fleet, Mr., patent obtained by, for medicines against the rot in sheep, 222.
 Fleets, extract taken from it respecting the ancient employment of oxen in husbandry in England, 60.
 Flocks, division of sheep into, preferred to folding them, 140.
 Flote fescue celebrated for the excellent qualities which the Cheddar and Cottenham cheese derive from it, 463.
 Flote fox-tail, in what soils best for cattle, 463.
 Fluid manures, 376, 377.
 Flux, affection of sheep by the, and its management, 210.
 Fly, account of that disorder in sheep, and applications for its cure, 210.
 Fodder, account of the culture and preservation of vegetables best calculated for, 47, and foil.
 Folding of sheep, observations on, 167, 168.
 Followers, remarks on, most convenient manner of distributing them, 144.
 Food for cows, 44. Importance of giving it with regularity, 153, 155. Quantity of, consumed by different beasts, 154.
 Foot-halt, a disorder peculiar to the feet of sheep, description of, 211.
 Foot-rot, remarks on that affection of the feet of sheep, remedies recommended for its removal, 211—214.
 Fother sheep, account of, 13.
 Fossil manures, 363. Crag, 363. Clay, *ib.* Chalk, 365. Coal-ashes, *ib.* Soap-boilers' ashes,

366. Gypsum, 367. Lime, 370. Marl, 373. Salt, 375. Sand, 376. Spot, *ib.*

Foul, directions for the removal of that disease, 195.

Fowler, the late Mr., his application to the breeding of cattle, 37, note.

Freemartin described, 42. Difficulty to fatten, 126.

French, or Alderney breed of cattle, specific characters of, 6.

Furze, manner of extirpating, 313. An useful article of winter food, 119. Its culture, 432. Value of furze ashes as a manure, 358.

G

Gad-fly, effects of on oxen, 206.

Gall, method of preventing that disease in sheep, 214.

Galloway breed of cattle, specific characters of, 5.

Gargut, causes of the, in swine, applications for relieving them, 230.

Garlic hedge-mustard, pernicious to milk, 117.

Gates, the construction and utility of, 406, 407.

Gelding of calves, observations on, 54, 55. Of Lambs, best time for, 78.

Gestation of sheep, 48.

Gloucester sheep, specific characters of, 9.

Gloucester breed of swine described, 24.

Grains, considered, as a nutriment for cows, 120.

Grass, its influence on the milk of cows, 117.

Observations on the different sorts of, *ib.* Time

of its highest maturity and luxuriance, 130.

Propriety of its being fed off by different cattle,

ib. If blown or breathed upon, obnoxious to

cattle, 134. General remarks on its produce,

136. Quantity required for the consumption

of a beast per day, 139. Considered as a

nutriment for sheep, necessary precaution in

feeding with it, 166.

Grasses, what sorts of, best adapted to meadows,

different soils, 419 and following. Proper

time of sowing, 431. Account of the natural

grasses best calculated for meadows and pas-

tures, 456, 456. Wild, the different sorts of

described, 456—464. Artificial, concise notice

of the best, 464—474.

Grass land, objects to be attended to in laying

out, 416, 417.

Grass lands, remarks on the culture and manage-

ment of, 407. See Meadow, Pasture.

Grass-seeds, rules laid down for obtaining them

of a good quality, 413. Best time and proper

method for sowing, 431.

Gravelly soils, improvement of, 232.

Grazier's Calendar, or work to be done through-

out the year, 367—372.

Grazing and grazing counties, reflections on,

125. Necessity of adapting the cattle to the

soil, 126.

Greaves, advantages derived from, for manuring

land, 162.

Green crops, best time for ploughing in, as ma-

nure, 357. See Artificial Grasses.

Grubber, a kind of Scarifier, account of, 251, note.

Gut-tie, prevalence of that affection in Hereford-

shire, description of its cure, 207.

Gypsum, the importance of, and account of its

uncommonly fructifying qualities, 367. The

beneficial effects of, as an article of manure,

368, 369, 370.

H

Hair-grass (silver), valuable for sheep-walks, 407. Water hair-grass, recommended for culture, 463.

Hall, Mr., experiment of, on feeding cattle with heath, 143, 149.

Hampshire breed of swine, described, 24.

Hams, different modes of curing, 188.

Hand-drill, account of, and its use, 257.

Hard-fescue, peculiarly entitled to the attention of practical agriculturists, 456.

Harness for oxen in ploughing, description of the, 58.

Harrison's, Dr., conjectures respecting the origin of the rot, 216. Interesting observations on the rot in sheep, 217—219, 220—225.

Harrowing, observations on, 317.

Harrows, observations on, 267. Bush and

brake harrows, *ib.* Lester's patent harrows,

268. Improved harrows by Mr. Young, 269.

By Mr. Knight, *ib.* By Mr. Wilde, *ib.* By

the Hon. R. Sandilands, 270. His Wrack-

barrow, 271. Mr. Jeffery's improved, 272.

Hawke, Lord, hints of, for conducting the important process of warping, 341—343.

Hay, infusion of, for young calves, 49. Time for

administering it, *ib.* Qualities of, described for

fattening cattle, its improvement by the addition

of succulent plants, 140.

Hay-making, superior method of, described, as

practised in the county of Middlesex, 439—442.

Hay-making in wet weather, 442. Observa-

tions of Mr. Boswell and Dr. Anderson on

making hay from grass on watered meadows,

443, 444. Suggestion of Dr. Darwin, 445.

Remarks on stacking, and manner of preventing

hay-stacks from taking fire, 446—449.

Hayward, Mr., improved extirpator of, 261.

Heath, or Forest breed of sheep, described, 13.

Heath, profitable food for cattle, 148.

Hedges, their utility as a kind of fence, and man-

ner of forming them, 396—405. The proper

season for planting hedges, and the most judi-

cious method, described, *ib.*

Heifers, spayed, the preference of, for grazing,

125. Wintering, remarks on, *ib.* Advantages

in their purchase for grazing, 128, 129.

Hemp-water, a useful manure, 376.

Herdwick breed of sheep, description of, 11.

Herefordshire breed of cattle, advantages of, 2, 3.

Herefordshire breed of sheep, specific characters

of, 10.

Herefordshire wheel-plough, 251.

Hides, a good criterion to judge of the disposition

of cattle to fatten, 31.

Highland breed of cattle, specific characters of, 6.

Highland breed of swine, described, 24.

Hodgsons, Messrs., their successful and improved

method of fattening cattle, 150, 151.

Hoes, account of the different sorts of, 262.

Horse-hoe, *ib.* Dutch hoe, 263. Mr. Macdou-

gal's hoe, *ib.* Turnip-hoe, 265, 266.

Hog, see Swine.

Hog, a term for sheep, 163.

Hogg, Mr., remarks on the seed in sheep, 226, 227.

Hoggets, or Hoggers, a term for sheep, 163.

Holcus lanatus, see Yorkshire White.

Hollow draining, account of, 267.

Hooching, see Cough.

Hop-clover, excellent for fodder, 465.

Horn shavings, where most advantageously employed for the fertilizing of land, 363.

Horns of sheep, how extirpated, 179, 180.

Horses, view of different breeds of, 16. Clydesdale horses, *ib.* Cleveland Bays, *ib.* Suffolk Punches, 17. Old English Draught Horse, 18. Remarks on the age of horses, 18-22. Sound horses, how indicated, 23. Their inferiority to oxen for agricultural purposes, 63, 64. For draught, their expense, 64, 65-67. The necessity of, in a farm, *ib.* General remarks on the different breeds of, their utility, 518. Their food, 521. Best form of stables for, 98-101.

Horse-hoe, account of that invented by Mr. Duckett, 265.

Horse-teams, their expense uncertain, 522.

Hoven, causes of that distemper, different remedies recommended for its treatment, 195-199.

Horse-feeding, general observations on, 132-140.

Horse-lambs, treatment and rearing of, 84-86.

Hunger-rot in sheep, treatment of, 214.

Hydrocotyle vulgaris, see Marsh Pennywort.

I J

Impediments to plough and scythe, hints for removing, 304-313.

Implements, agricultural, account of, 232-275.

In-calvers, account of, their advantageously fattening, 126.

Inclosures for cattle in grazing, the propriety of, examined, 127. Size and shape of, 390-394.

Irish breed of cattle, 38, 39.

Irrigation, the improvement of land by, considered, 318. Manner of conducting, 319-327. Manner of watering low lands, &c., 328-335. Observations on the proper times for flooding or irrigating, 335. Known only in two parts of the United States, 339. How conducted in America, *ib.* 340.

Jeffery's, Mr., improved barrow, 272.

K

Kaimes, Lord, observations of, on the labour of oxen, 62. Propositions of, respecting the purchase of beasts by weight, 159. Application of his rule to Scotland, but not to England, *ib.* 160.

Kentish turn-wrest plough, described, 251.

Keep, expense of, and savings with oxen, its contrast with that of horses, 64, 65.

Kirwan, Mr., observations of, on the atmosphere in the different seasons in England, 192, 193.

Kitchen gardens, the utility of, 114.

Knight, Mr., opinion of, respecting a hog in good condition, quantity of food necessary for its fattening, &c., &c., 184. Description of his improved turnip-drill, 255, 256. His improved barrow, 272.

Kyloes, a breed of cattle, described, 6.

L

Labourers, advice to guard against the frauds of, 345, note.

Lambs, weaning of, 77. Best time for gelding them, 78. Their principal diseases and cure, 229, 230.

Lincolnshire breed of cattle, specific characters of, 4.

Land floods, successful application of, in watering pasture lands, 333.

Lasteyrie, Mr., remarks on sheep-shearing, 79, 80. Explanation of the practice of docking sheep, 179. Statement respecting the dunt, 209. Advice for the cure of the rot, 220, 221. Account of the Prussian dog, 517. Manner of marking sheep, 537, 538.

Leached, or soap-bolers' ashes, statement of the great fertilizing properties of, 366.

Lentils, culture of, 483.

Lester's, Mr., patent barrows, 263. Cultivator, 260.

Lewis, Dr., composition of, for marking sheep, 83.

L'Hommédien, Mr., his treatment of calves, 48.

Lime, extensive utility of considered as manure, 370. Process of calcination described, *ib.* 371.

Lincolnshire Sheep, specific character of, 9.

Linseed recommended as fodder for calves, by Mr. Crook, 50.

Linseed-oil cake, use of, for fattening cattle, 149, 150.

Loam, the different sorts of, considered, 281.

Hints respecting the improvement of, *ib.* 282. Grasses proper for loamy soils, 420.

Lotium perenne, see Darnel.

Looseness, origin, causes of, and remedies for that disorder in cattle, 199, in calves, 207.

Longing of cows, treatment of, 44.

Lowland breed of cattle, specific characters of, 7.

Lucecock, Mr. observations of, on wool, 524 et seq.

Lucerne, preferable methods of cultivating it, 466.

Expense attending it, 467, 468. Its uses, *ib.* 469.

Lange, diseases of in swine, treatment of, 231.

M

Macdougall's, Mr., chaff-cutter described, 244. His improved hoe described, 261, 262.

Magnis, Count de, his method of shearing sheep, 79, 80 note.

Malt dust, application of, as a manure, 357.

Mange in swine, treatment of, 231.

Mangel-wurzel, good qualities of, for cows, 119. Culture of, 476.

Manure, great improvement of, derived from stall-feeding and soiling, 156. The different classes of, described, 346. The employment of vegetable ashes considered, *ib.* Vegetable manures, *ib.* Vegetable ashes, *ib.* Lord Meadowbank's process for converting peat-moss into manure, 347-354. Straw, *ib.* Weeds, 355. Sea-weeds, 356. River and pond weeds, *ib.* Rape or cole-seed cake, *ib.* Malt dust, 357. Oak bark, *ib.* Ploughing in green crops, *ib.* Woodsoot, 358. Furze ashes, *ib.* Animal manures—Dung, 359. Urine, 361. Tallow-chandlers' waste, 362. Fish, *ib.* Bones, 363. Horn shavings, *ib.* Damaged wool, *ib.* Fossile Manures—Crag, 364. Clay, *ib.* Chalk, 365. Soap-bolers' ashes, 366. Gypsum, 367-369. Lime, 370-372. Phosphate of Lime, 373. Marl, *ib.* 375. Sall, *ib.* Sand, 376. Soot, *ib.* Fluid Manures, *ib.* Mud, 377. Compound Manures, preparation and management of, 378-380. Preservation of manures, 380-384. Application of manures, *ib.* Rules for manuring land, 385-390.

Mares, attention requisite to be paid to them, 519, 520.

Marking of sheep, composition for, 83.

Marl, account of the different species of, and their application as manure, 374, 375.

Marsh pennywort, its baneful effects on sheep considered, 165.

Marshall, Mr., his estimate of the necessary pro-

- portions for working cattle, 28. Remarks of, on the management of cattle with turnips, 142-145. His observations on the cure of the fly in sheep, 210. His description of the maphrodites or hermaphrodites, a peculiar sort of carriage used in Norfolk, 235. The great success of summer-fallowing proved by, 300, 301. Method recommended by him for destroying ant-hills, 418, note.
- Mason, Mr., contrivance of, for relieving hoven cattle, 196, 199.
- Meadows, the manner of irrigating them, and draining the water off, described, 319 & seq. General remarks on the qualities of land best suited for, 411, 412. What seeds best calculated for, 423, 424.
- Meadowbank, (Lord) hints of, for converting peat moss into manure, 347 and foll.
- Meadow cat's-tail, enquiry into the produce of, 460.
- Meadow-fescue, employed with advantage as fodder for cattle, 454.
- Meadow fox-tail, considered as one of the first grasses on account of its utility, 454.
- Meadow-grass, see *Poa*.
- Meadow soft-grass, precautions necessary to attend to in offering it to cattle, 455.
- Measles in swine, treatment of, 231.
- Medicago sativa*, see *Lucerne*.
- Merino or Spanish sheep, by whom imported, and descriptive characters of, 14, 15.
- Middleton, Mr., observations of, on draining clayey soils, 292. His observations on the qualities of dung, 359. His account of hay-making in Middlesex, 439-442.
- Midlands, what seeds best calculated for, 422, 423.
- Midch kine, see *Cows*.
- Milk, from what cows the best obtained, 39. Its drying up, when best performed, 41. Substitutes for, see *Calves*. Best pasture for milk, 116 and foll. Means of improving it, 119, 120.
- Milk and cream, remarks on the management of, in the dairy, 490-502.
- Milking, time for, after calving, 44-47, should be three times a day, 492.
- Miller, his recommendation of parsley as a preventive of the rot in sheep, 219.
- Mills, Mr., observations of, on the feeding of sheep to prevent the rot, 219.
- Miner, a species of plough, described, 253.
- Mixture for cows after calving, 44.
- Molasses used as a nutriment, introduction of that practice from the West Indies, their composition with other articles, &c. &c., 152.
- Mole-hills, effectual practice for their removal, as recommended by Dr. Darwin, 418, note.
- Mole-plough, its construction and use described, 258.
- Moore, Dr., instrument invented by, for relieving hoven cattle, 196.
- Monthly Remembrancer of work to be done throughout the year, 567-573.
- More, Mr., his valuable invention for ascertaining the force necessary in the draught of various ploughs, 260.
- Morgan, Mr., contrivance of, for keeping stalls clean, 103.
- Mould, vegetable, observations on the nature of, 279.
- Mowing grass, the time for, 437. Best method of mowing, 438.
- Mud, value of, used as a manure, 377.
- Mannings, Mr., turnip-drill invented by, 25. His method of preserving turnips, 493, 494.
- Murrain, in swine, treatment of, 232.
- Mascovado Sugar, experiments on feeding sheep with, 171-176.

N

- Neil, Mr., his improved mode of forming thorn-hedges, 472, 473.
- New lays, the management of, described, 433, 434. Practice of mowing them considered, *ib*.
- Nicbolls, Mr., invention of, for preventing mischief by vicious bulls, 33, 34.
- Night-soil, preparation of, as a manure, 361.
- Norfolk custom in the yeaming of lambs, 77. Manner of turnip-fattening cattle in that county, 142-145. Breed of sheep described, 13.
- Norfolk Wheel-plough, described, 249.
- Northumberland, Duke of, his proposition for substitution of milk, 48. Success of his experiment, 49.
- Northampton breed of Swine, described, 24.

O

- Oak-bark, value of as a manure, 357.
- Oats, culture of, 423.
- Out-grass, tall, its time of flowering, and proper ties, 459. Yellow out-grass, its time of flowering and properties, *ib*.
- Offices, see *Farm-offices*.
- Oil-cake, as an article of food for cows, 120; and for fattening cattle, 149, 150.
- Ointment for the mange, recommended by Dr. Norford, 231.
- Old-English Draught Horse, 18.
- Ox, the utility of, 55. The different breeds, observations on, *ib*. Employment of this animal for the plough, 56. Training for the plough, necessity of attention in, *ib*. 57. Manner of training and working them in the North, *ib*. General character of the, 58. Manner of harnessing them in England, Portugal, and France, *ib*. Advantages from shoeing them, 59. Remarks on the idea of their preference to horses, 56. Utility of, superior to horses, *ib*. Cost, their original, compared with that of a horse, 61. Labour of, according to different statements, 62. Superiority of, over horses, proved in Ireland, 63. Manner of working them practised by Lord Somerville, 63, 64. Their steadiness of draught, observations on, 64. Devonshire breed of, remarks on, *ib*. Expense of their keep compared with that of the horse, *ib*.—67. Economy in keeping them, *ib*. Remarks, summary, proving their preference to horses in agriculture, 67, 68. Superiority of oxen for grazing, 67. Interesting fact respecting their management in Norfolk, 144, 145. Hints on the different quarters of beasts, their constituent parts, weight, value, &c. 159, 160. Diseases to which they are subject, 206. Effects of the ox-fly, 206.
- Ox-fly, infection of oxen by the, explained, 206.
- Oxford, its pasturage, 125.
- Ox-stalls, remarks on the site best adapted for them, their interior structure, dimensions, &c. &c. 94-98.

P

- Palluel, M. de, his communication respecting the feeding of sheep, 171.
- Pantas or Panting-evil, remarks on that disease, and treatment of cattle labouring under it, 200.

- Paring, description of, and proper season for employing the practice of, 301. Manner of performing that operation, *ib.* 302, 303.
- Paring plough, utility of the, 259.
- Parkinson, Mr., the ingenuity of, in the construction of bees, 296. Observations of, on laying down lands to grass, 430.
- Parry, Dr., his successful efforts in improving British wool, 525.
- Parsley, employed by Mr. Miller as a preventive of the rot in sheep, 219.
- Parsnips, their excellence in fodder for cows, 119. Great utility derived from their use, 141. Culture of, 430, 431.
- Pasmore, Mr., his invention of a useful machine for cutting straw described, 245.
- Pastures, advantages and inconveniences of hard or light stocking them considered, 123—130. The best method of laying them out, and description of the land best adapted for the purpose, 408—410. Hints for improving and beautifying pastures, 432—437. Pasture for calves, description of, 48. Pasture for sheep, strictures on the care requisite in its selection, 163, 164. In summer, attention necessary to be paid to, 165, 166.
- Peas, culture of, 484.
- Peat, theories respecting the formation of, 283, 284. The nature of such soil investigated, and manner of treating it pointed out, *ib.* System for converting peaty soils, recommended by Sir John Sinclair, 285. Grasses proper for peaty soils, 420 & seq. Well calculated as manure for grass and arable land, 347—354.
- Peat ashes, quantity requisite to manure an acre, 354.
- Peat-borer, description of the one invented by Mr. Eccleston, 295.
- Peat-moss, its application as manure, 347. Manner of preparing it for the purpose, *ib.* 348—354.
- Pelt-rot, treatment of sheep affected by, 214.
- Pens for calves, see Calf-pens.
- Phleum pratense*, see Meadow cat's-tail.
- Pig, see Swine.
- Piggery, importance of, in rural economy, 104. Its arrangement described, *ib.* 105. Expense of, in building, *ib.* Interior of the, specified, *ib.*
- Pigs, time for weaning them, 88.
- Pisum sativum*, see Peas.
- Plantago lanceolata*, see Rib grass.
- Plashing, of quackset-bridges, how performed, 404, 405.
- Plaster-stone, or Gypsum, value of, as a manure, 307—309.
- Plough, impediments to that implement considered, 304—313.
- Ploughs, observation on, 246. Account of the Swing plough, *ib.* Rotherham plough, 247. Small's patent or chain plough, *ib.* Improved Scottish plough, 248. Norfolk Wheel Plough, 249. Beverstone plough, *ib.* 250. Herefordshire plough, 251. Kenish Turn-wrest plough, *ib.* Mr. Duckett's two-furrow plough, *ib.* Paring plough, 252. Trench plough, *ib.* Miner, 253. Drill ploughs—Tull's, *ib.* Young's, *ib.* Amos's, *ib.* Cook's, *ib.* Munnings's Turnip-drill, 254. Mr. Knight's, 255, 256. Hand-drill, 257. Scott's Mole-plough, 258. Watts's Mole-plough, *ib.* Duke of Bridgewater's Drain-plough, 259. Contrivance for ascertaining the draught of ploughs, 260.
- Ploughing by oxen, preference of, to that by horses, 63, 64. General remarks on, 314, 315. Deep ploughing, when necessary, *ib.* When prejudicial, 316. Best time for ploughing in green crops, 357, 389. Advantages of ploughing land, 316, 317.
- Poa, smooth-stalked, the superior qualities of the, as an article of fodder, 454. Annual, recommended as excellent food for milch cows, 456. Rough stalked, 457. Flat-stalked, or Creeping-Poa, 460. Water-Poa, 463.
- Poisons, management of cattle affected by, 201.
- Ponds, for drinking, best size for, in a farm-yard, 108, 109. Best manner of making them, *ib.* Cement for making them retentive of water, *ib.* Artificial, for dry soils, 106. Method of constructing them, *ib.* 107. Mud of, a valuable manure, 348. Pondweeds, an useful manure, 356.
- Pork, improved mode of salting, 189.
- Potatoes, their good effect on milch kine, 119. Manner of preparing and giving them to cattle, 147, 148. Culture of, 405, 487.
- Poultry, hints for rearing, 541 & seq.
- Pounds, their convenience, and manner of arrangement, 115.
- Preservation of Manures, 380—384.
- Price of oxen, 61.
- Price, Mr., advice of, with respect to the treatment of sheep liable to the rot, 220.
- Proportions of feed consumed by cattle, 154.
- Protector for Wheals, described, 240, 241.
- Pulteney, Dr., observations on the water crow-foot, as food for swine, 183.
- Purge recommended in the colic, 194.

Q

Qualities, good, of sheep, remarks on the, 69—72. Hints on the qualities to be regarded in the choice of cattle, 28—32.

R

Ragweed, how to extirpate, 311, 312.

Rams, requisites in a good breed of, 70. Their proper proportion to the ewes, 71.

Rape cake, pulverized, a good manure, 326.

Ray grass, value of, and its culture, 453.

Rearing of calves, see Calves.

Red Beet, value of, for cattle, 146.

Red-water, symptoms of the, practice recommended for its removal, 201. Successful practice in the cure of sheep under that affliction, 214, 215. In lambs, 295.

Reed Meadow-grass, 463.

Regularity, importance of, in feeding calves, 63. And in feeding cattle generally, 153, 154. In feeding sheep, 176, 179. In feeding swine, 186.

Remembrance, Monthly, of work to be done throughout the year, 567—572.

Rennet, preparation and management of, 506, 507.

Rib-grass, various opinions respecting the qualities of, as food for the different sorts of cattle, 462.

Rickets, remarks on that fatal disorder in sheep, 215.

Rivulets, advantages derived from, in agriculture, 332.

Rollers, observations on the structure of, 273.

Rolling, the most preferable manner of, explained, 313.

Rolling cart, account of, 241.
 Romney-marsh sheep, character of, 11.
 Roots, the quantity necessary for cattle, according to their relative state, described, 153, 154.
 Root-stemmer, an improved, account of, 106, 107.
 Rot in sheep, origin of that affection attributed to flooded lands and inferior herbage, 165. Prevented in lambs by suckling, 166. Opinions on the origin of the, 216—219. Its symptoms, 217. Of the treatment of that malady, 219, 220. Account of the inoculation practised in Germany for the, 220—221. Influence of the various pastures on the, 223—225.
 Rotherham plough, account of, 247.
 Rotten, great value of, to sheep, 77. General observations on the advantages derived from, 450.
 Rough cock's-foot, see Cock's-foot dactylis.
 Rubbers in sheep, remarks on the, probability of relief by ablution with soap-suds or ley, 226.
 Rubbing-posts, their service in inclosures described, 128.
 Radgwick breed of Swine, description of, 24.
 Ruta Baga, or Swedish Turnip: see Turnip.
 Rye, culture of, 462.
 Ryelands, or Herefordshire breed of sheep, specific characters of, 10.
 S
 Salaftein, culture and uses of, 469, 470.
 Sale of beasts, general observations on, criterion for ascertaining their proper maturity, 157. Of the most reasonable periods for disposing of them, *ib.* Hints on the manner of arranging them in lots, 158. Remarks on their sale by weight, 159, 160. Tables for this purpose, 161, 162.
 Salsbury, Mr., his mode of forming permanent meadows, 429, 430.
 Salmon, Mr., description of a chaff-cutter invented by, 242, 243.
 Salt, its importance in preserving the health of sheep, 178. The singular utility of, as a fobbe manure to pasture lands, 375.
 Sand, description of the lands on which this substance may be employed with advantage, 375. Management of sandy soils, 282, 283. Grasses proper for them, 421.
 Sandiland's, Mr., improved harrows of, 270. His wrack-barrow, 271.
 Saving, in keep of oxen and horses, comparative view of, 61, 65.
 Scab, in sheep, treatment of, 225, 226.
 Scalp-plough, description of, 261.
 Scourifiers and hoes, remarks on the principal, 260 & seq. Mr. Hayward's extirpator, 261. Description of Mr. Macdougall's scarifier, *ib.* The horse-hoe invented by Mr. Amos, and others, 262. The scuffle, or Dutch hoe, *ib.* 263. The prong-hoe, *ib.* Mr. Macdougall's hoe, *ib.* 264. Turnip-hoe, 265.
 Scottish plough, improved, account of, 248.
 Scott, Mr., his ingenious mole-plough described, 238.
 Scouring, affects oxen and cows, 399. In calves, 207.
 Scour, see Gall.
 Sea-sand, well calculated for clayey lands, 376.
 Sea-weed, an useful article of food for cows, 122. A valuable manure, 356.
 Seasons, influence of the, on the weather, explained, 191, 192.

Seeds, hints for procuring the best, 415. Manner of varying them, as recommended by Mr. Young, and in what proportion for different soils, 419. Various rotations of, described, 420 and following.
 Seymour, lord Robert, an excellent one-horse cart invented by, 258, 259.
 Shearing, an expression for sheep, 163. Operations of, 79—81.
 Shear-bog, or diamond top, or ram, an appellation given to sheep, 163.
 Shearling, a term used to denote sheep, 163.
 Sheep, synoptical table of breeds of, 528. Account of each different breed, 8. Dishley breed, characters and advantages of, *ib.* Lincolnshire, 9. Teeswater breed, *ib.* Cotswold, or improved Gloucester, *ib.* Dartmoor, or Devonshire Natts, *ib.* Herefordshire, or Ryelands, 10. South-down, *ib.* Cannock-heat sheep, 11. Romney-marsh, *ib.* Herdwick breed, *ib.* Cheviot sheep, *ib.* Dun-faced breed, 12. Shetland breed, *ib.* Exmoor breed, *ib.* Dorsetshire breed, 13. Norfolk sheep, *ib.* Heath, or forest sheep, *ib.* Merino or Spanish sheep, 14. Their utility and importance, 69. Consideration of, in a wild or natural state, *ib.* Attention requisite in the selection of, *ib.* 70. Purchase of, a matter of caution, necessity of suiting them to the quality of the soil, 70. Superior sorts, signs of, *ib.* Wool of, 71. Ewes, their prolific nature, 72. Yearling, time of, 73. Ewes, their blossoming *ib.* Gestation, duration of, 72. Yearling, attention requisite at that time, 73, 74. Custom in Norfolk, 74. Lambs, their treatment, *ib.* Turnips, influence of, on the ewes, *ib.* Feeding of, in spring, 76. Lambs, weaning, best time for, 77. Gelding of, time for, 78. Shearling of, when seasonable, *ib.* Shearing, operations of, 79—82. Marking of, composition for the, 83. Observations on sorting them, 83. Treatment of, for stock, 84. Horse-lambs, the rearing of, 84. Treatment of, while suckling, 85. Their value, 86. Methods of watering them on the Continent, 166. The English manner, *ib.* Different terms for sheep in various counties, 163. Necessity of suiting them to the pasture, *ib.* Observations on various methods practised in the grazing of sheep, 164, 165. Origin of the rot explained, 165. Noxious practice of pasturing horses with sheep, *ib.* Account of some vegetables pernicious to sheep, *ib.* Sackling, a preservative against the rot, 166. Precaution necessary in turning them into pasture, *ib.* Description of the summer pasture, and appropriate manner of distributing them, 169. Their close feeding described, *ib.* Observations on the practice of folding them, 170. Their division into flocks preferable to the practice of folding, *ib.* Experiment upon fattening, 171. Experiments on feeding them with muscovado sugar, 171—176. French practice of sheltering them at noon, 176. Regularity necessary in feeding them, 176—179. Necessity of giving them salt, 176. Brief account of the principal diseases to which they are liable, 208—225. New method of marking them, 535, 536.
 Sheep pasture, draining of, 290. What grazes are best adapted to be sown for, 419 and following.
 Sheep-shearing, Swedish method of, 79 note. Observations on sheep-shearing, 79—82.
 Sheep's-fescue, brief account of, 456.
 Shepherds, attention requisite on their part to their flock, 180.
 Shepherd's dog, great utility of the, 515, 516.
 Shetland breed of sheep, description of, 12.

- Shoeing of oxen, advantages from, 59. Manner of performing the operation, *ib.*
- Short-horned breed of cattle, characters of, 3.
- Shoote, rational treatment of that most fatal malady, 208.
- Sinclair, sir John, remarks on the improvement of the breed of the cow, 40. His observation respecting the period for sending the cow to bull, 41. His directions for improving peaty soils, 235.
- Skil, in lambs, treatment of, 230.
- Sky, Isle of, breed of cattle, 38.
- Small's plough, account of, 247.
- Smooth-stalked pea, the great utility of, as an article of food for cattle, described, 454.
- oil, knowledge of its quality indispensable, 27.
- Soils, the constituent parts of, 277. Criterion for ascertaining their fertility, 278. Vegetable mould, 279. Clay, *ib.* Loam, 281. Gravelly and sandy, remarks on, 282. Chalky soils, 283. Peaty soils, *ib.* The necessity of obtaining an acquaintance with the peculiar sorts of, for good meadows, 414. Proportion of grass-seeds for different, 420 and *fol.*
- Soiling, advantages attending that mode of feeding, 132, 139. Of sheep, 169, 170.
- Sowbolders' aches, value of, as a manure, 305.
- Somerville, lord, his manner of working oxen, 63, 64. Tables of, respecting the calculation of the weight and value of cattle in different counties and districts, 161. His table of prices, 162. His improved carts, 239, 240. Advantages derived from his additions to the wheel-plough, 251. His attention to the improvement of wool, praiseworthy, 525, 534.
- Scot, from coals superior to that obtained by the burning of wood, for the purpose of manuring land, 376. To what soils most suitable as a manure, *ib.*
- South-down breed of sheep, 10.
- Scar food, manner of preparing it, and prevalence of feeding cattle with the same in France, 150. Its effect on cattle, *ib.*
- Sow, see Swine.
- Spanish breed of sheep, account of, 14, 15.
- Spearwort, the lesser, its unwholesome quality for sheep, described, 105.
- Spring-grass, remarks on its use as fodder for cattle, 455.
- Springs, beneficial effects derived from, on coarse lands, 332.
- Springy land, the most proper method of watering it, described, 330.
- Sperry, utility of, for cows, 119. Its culture, 472, 473.
- Stable, description of the situation best calculated for the erection of the, 93. Importance of arrangement and formation of the managers and racks, 99, 100. Of the pavement and dimensions of the stalls, 100, 101.
- Stallion, rules for choosing, 519.
- Stalls, new method of keeping them clean, 100. For fattening cattle, the most remarkable near London, 151.
- Stall-feeding, general observations on, 121. Vegetables proper for, 140.
- Starch factories, refuse of, advantageous to the fattening of hogs, 135.
- Steamer for roots, description of, 105, 107, advantage of steamed food, 122-124.
- Stocking a farm with cattle, observations on, 27-32. Hard and light stocking of pastures, considered, 130, 132.
- Stones, means recommended for their removal from the soil, 305.
- Straw, burnt, advantageously employed as an article of manure, 354. Value of dry straw as a manure, *ib.*
- Straw-cutter, account of Mr. Salmon's, 242. Mr. Macdougall's, 244. Mr. Pasmore's, 245.
- Straw-house, the utility of, 105.
- Strickland, Mr., his account of irrigation in America, 339, 340. His inquiries into the produce of the meadow cat's-tail, 460.
- Suffolk punches, a breed of horses described, 17.
- Suckling of lambs, remarks on, 85. A preservative for lambs against the rot, 169.
- Sugar, experiments on feeding sheep with, 171-175.
- Sussex, breed of cattle, notice of, 2.
- Sweden, method of shearing sheep in, 79 note.
- Sweet-scented vernal-grass, remarks of various agriculturists on the qualities of, 455.
- Swine, account of the principal breeds of 23. Berkshire breed, *ib.* Black or Chinese breed, *ib.* Gloucester, 24. Hampshire, *ib.* Northampton breed, *ib.* Radgwick breed, *ib.* Swing-tailed breed, 25. Large spotted, Woburn breed, *ib.* Remarks on their profitable keep on a farm, 86. Characteristics of a good hog, according to his external appearance, *ib.* Time when they are capable of propagation, period of gestation, number generally produced, &c. 87. General hints on the management of hogs kept solely for the purpose of breeding, and particularly of sows about their first farrowing, *ib.* Time for killing sucking pigs, 88. Of their weaning, when and in what manner performed, *ib.* Remarks on sows and boars, and the time they are fit for generation, 89. Necessary advice in buying and selling either fat or lean swine at markets, *ib.* Division of, into sows with pig, store pigs, and fattening hogs, 181. Attention necessary to be paid to them while in pig, *ib.* Proper food for young pigs described, 182. Store-pigs, manner of treating them with advantage, *ib.* Remarks on feeding them with water crow-foot, and its good effect proved, 183. Articles of winter food for them pointed out, *ib.* Fattening, proper seasons and food for, *ib.*-185. Time requisite for fattening them, 185. Cleanliness, beneficial consequences derived from it; and refutation of prejudices on that head, *ib.* Regularity of feeding them, its influence on fattening swine considered, 186. Most suitable time for their disposal, *ib.* Remarks on the best modes of converting their flesh into bacon and pork, 187-189. Description of the practice of curing hams in Westmoreland, *ib.* New method of salting the flesh for pork, 129. Account of, and observations on the diseases incident to swine, 230-232.
- Swing-ploughs, description of, 245.
- Swing-tailed breed of swine, described, 25.

T

- Tables for ascertaining weight and value of cattle, 161, 162. For calculating wages, 565. For calculating the expense of work per acre, 566.
- Tall oat-grass, how best turned to advantage, 459.
- Tanners' waste, value of as a manure, 357.
- Tares, the tendency of to improve milk, 120. Their culture, 473.

Toeswater sheep, specific characters of, 9.
 Teeth of harrows should be round, and why, 207.
 Thistles, how to extirpate, 310, 311.
 Thorns, best adapted for fences, 396, 397.
 Ticks, preparation for removing, from sheep, 227.
 Timothy-grass, culture and value of, 469.
 Tool-house, observations on the structure of, 103.
 Trench-plough, account of the, its improvement by Mr. Duckett, 252.
 Tubb, Mr., his substitute for the ringing of pigs, 89.
 Tagwell, Mr., his improvement of the Beverstone plough, 249, 250.
 Tambril, a new-invented machine used in feeding sheep; remarks on the advantages resulting from its use, 176, 177.
 Turkeys, hints for rearing, 544, 545.
 Turnips, their influence on sheep, and on the milk, 74. The effect of, on much kine, 120. On their use as an article of winter-food, various results from their use, proper mode of preparing them, 141, 142. Norfolk mode of turnip-feeding cattle, *ib.*—146. Their culture, 489—494.
 Turnip-drill, description of its structure, and advantageous employment, 254—256.
 Turnip-hoe, account of a newly-invented, 265, 266.
 Two-furrow plough, account of the, 251.

U

Udder, the hardness of the, remedied, 44. Other affections of the, applications necessary for the relief of, 205. Udder of ewes, affections of the, applications recommended for their cure, 228.
Ulex Europæus, see Furze.
 Uplands, the system of draining them explained, 292—295. Grasses proper for upland pastures considered, 422.
 Urine, the fertilizing qualities of, pointed out, 361. The valuable effects derived from, on pastures or meadows, 362.
 Utensils of a dairy, management of, 497.

V

Vegetables, what sorts best calculated for fodder, 474—494.
 Vegetable mould, observations on, 279.
 Vegetable manures, 346. Ashes, *ib.* Peat-moss, 347—354. Straw, 354. Weeds, 355. Sea-weeds, 356. River or pond weeds, *ib.* Rape cake, 356. Malt-dust, 357. Tanners' waste, *ib.* Green crops, ploughed in, 357. Wood-dust, 358. Furze-ashes, *ib.*
Vicia, see Beans, Tares.
Vicia sepium, see Bush Vetch.

W

Waggons, observations on, 233, 234.
 Walls, their employment as fences, described, 295.
 Warping, general remarks on the great advantages derived from, 341—345.
 Warwick, soil of, its quality for grazing, 125.
 Wash, on its application to cattle, 150, 151.
 Washing of sheep, observations on, 78—80.
 Water, general remarks on, and its use for cattle, 107. Remarks on the different qualities of, and whence these originate, 331—333. Stagnated, injurious effects of, to land, 319.

Watering of sheep, observations on, 166 note.
 Water-crow-foot, the qualities of, as an article of food for swine, 183.
 Water-hair-grass, reported to contribute much to the fine flavour of Cambridge butter, 463.
 Water meadows, irrigation of, how conducted, 319 and foll.
 Water-poa, account of, one of the largest and most useful British grasses, 463.
 Watt, Mr., improvement of the mole-plough by, 258.
 Weaning of lambs, 77.
 Weather, variations of, indicated by certain phenomena, 190—192.
 Webster, Mr., the beneficial effects resulting from warping, explained by, 344.
 Weeds, different sorts of, 307, 308. Annual weeds, how extirpated, 308, 309, 310—313. Description of a weed-extirpator, 311. Their service as manure, 355, 356.
 Weight of cattle, observations on ascertaining, 159, 160. Tables for this purpose, 161, 162.
 Welch breed of cattle, specific characters of, 7.
 Wells, new manner of constructing them, 108.
 West, Mr., description of the racks of the stalls built by; economy of that contrivance, 99.
 Wether or Wedder hogs, a name given to express female sheep, 163.
 Wheel-carriages, general remarks on their different structure in various countries, 233. Description of various, *ib.*—234. The Irish improved car, 235. Construction of a new drag-cart, 239. Simplicity of the Cornish wain, 240. Account of a useful rolling-cart, 241.
 Wheel-ploughs, account of, 259 and foll.
 White scour, origin of the, and management of sheep affected by it, 229.
 Wilde, Mr., improved barrows of, 269.
 Wild, or native breed of cattle, 1. Specific characters of, *ib.* Quality of flesh, *ib.*
 Willows, the employment of, for breaking the force of the tides, and for the defence of banks, considered, 343.
 Winter food for sheep, the most useful articles of, pointed out, 170.
 Woburn breed of swine, 25.
 Wood, method of eradicated, on farms, 313, 314.
 Wood-soot, beneficial effects of, as manure, 358.
 Wool, the length of its staple affected by irregular feeding of sheep, 179. Locks of, useful for manuring land, 363. Hints for the improvement of, 523. Names given to wool, *ib.*—524. British wool improved by crossing with Spanish sheep, 524. Requisites necessary to constitute good wool, 525—527. Classification of wool-bearing animals, 527. Mr. Culley's Synopsis of British Native Sheep, 528. Total value of English wool, 530. Observations on its relative firmness, 531. Hints for improving fibres, 532—534. And for an improved mode of marking sheep, 535.
 Wounds, general observations on the treatment of, in cattle, 202. In sheep, treatment of, generally described, 228, 229.
 Wright, Messrs., improved churn, invented by, 272.
 Wright, Mr., opinion of, with respect to the haying meadows dry in November and December, 326, 327.

Y

- Yarrow, considered as one of the most common and valuable plants for every description of cattle, 461.
- Yensing, observations on, 74.
- Yellow oat-grass, different opinions on the qualities of, 459.
- Yoking of oxen, remarks on, 58, 59.
- Yorkshire white-grass, how best calculated for sheep, 455.
- Young, the Rev. Mr., experiments made by, concerning the use of Timothy-grass, 461.
- Young, Mr. A., advice for weaning pigs, 88. His plan for building a farm-house described, 90, 91. His plan of a piggery, 104, 105. Remarks of, on the necessity of discriminating between the

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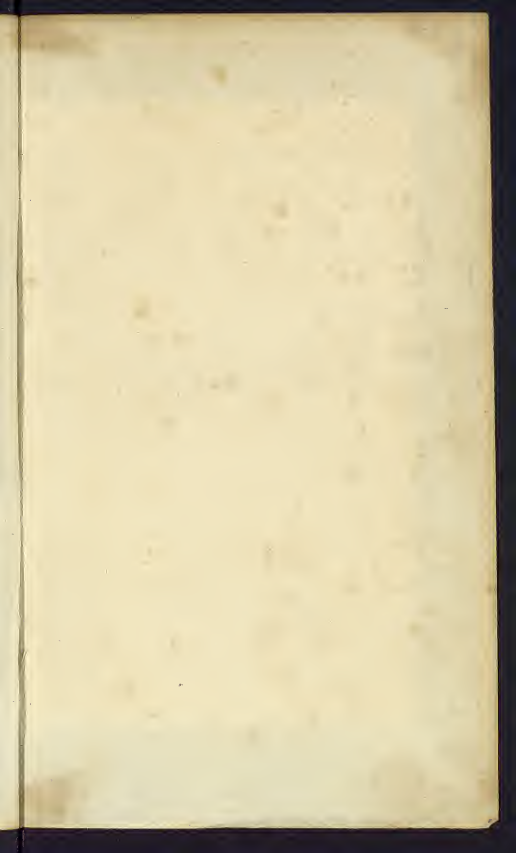
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